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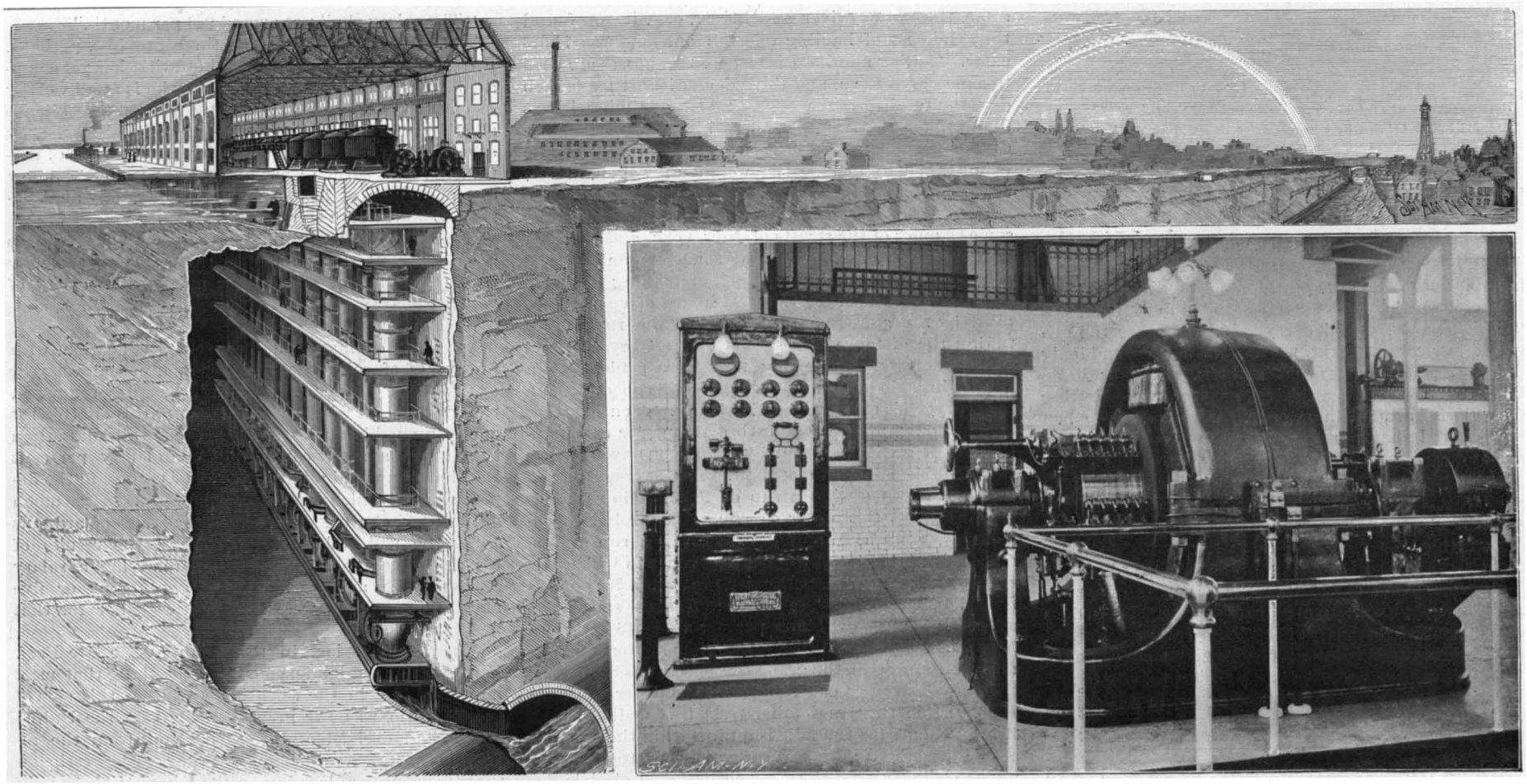
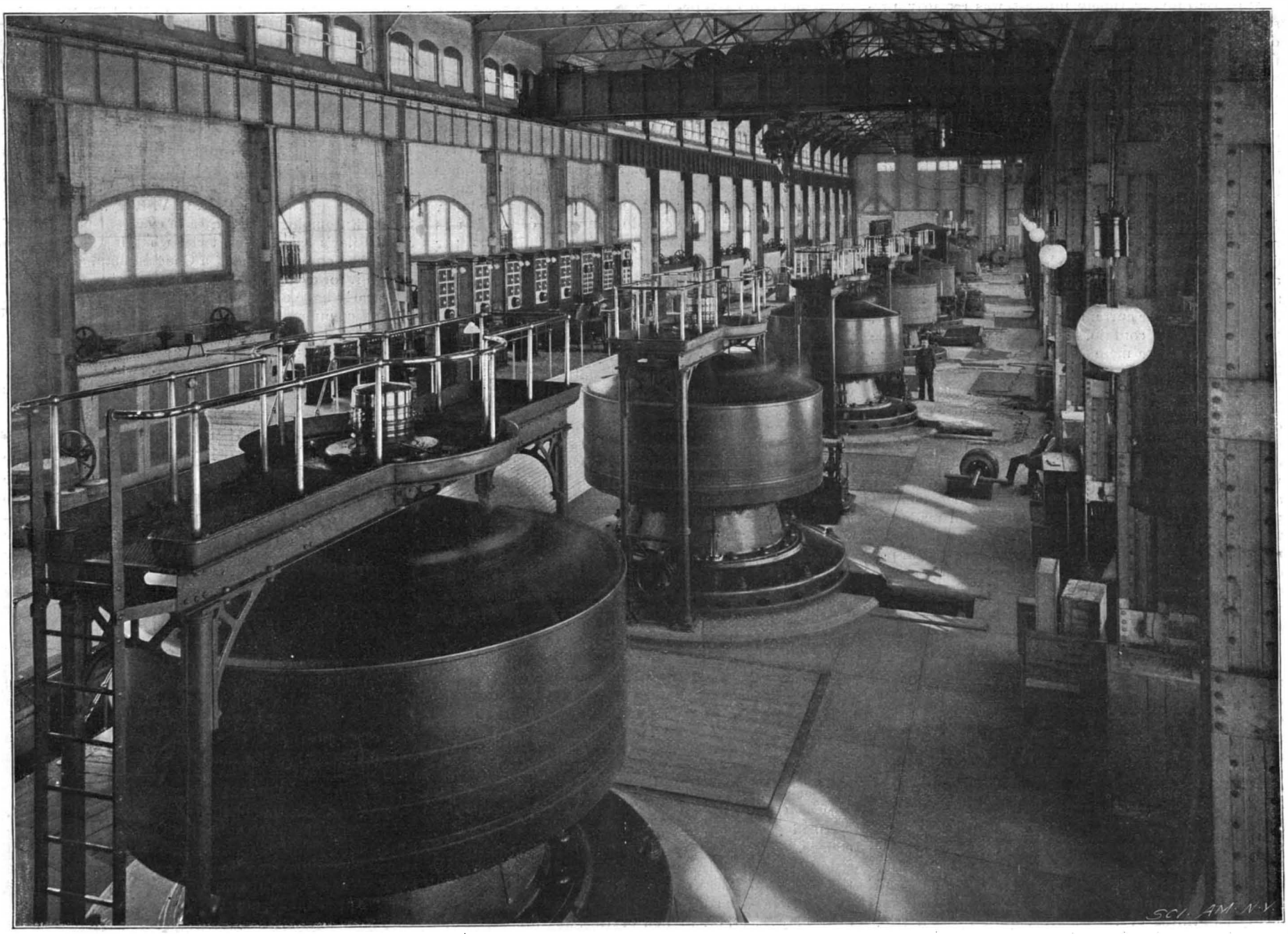


1.—Sectional View of Power House, Wheelpit and Tailrace Tunnel.

2.—Rotary Transformer for Local Railway Supply.



3.—The 50,000 H. P. Power House, with Eight 5,000 H. P. Generators Installed.

NIAGARA FALLS POWER PLANT.—III.—[See page 56.]

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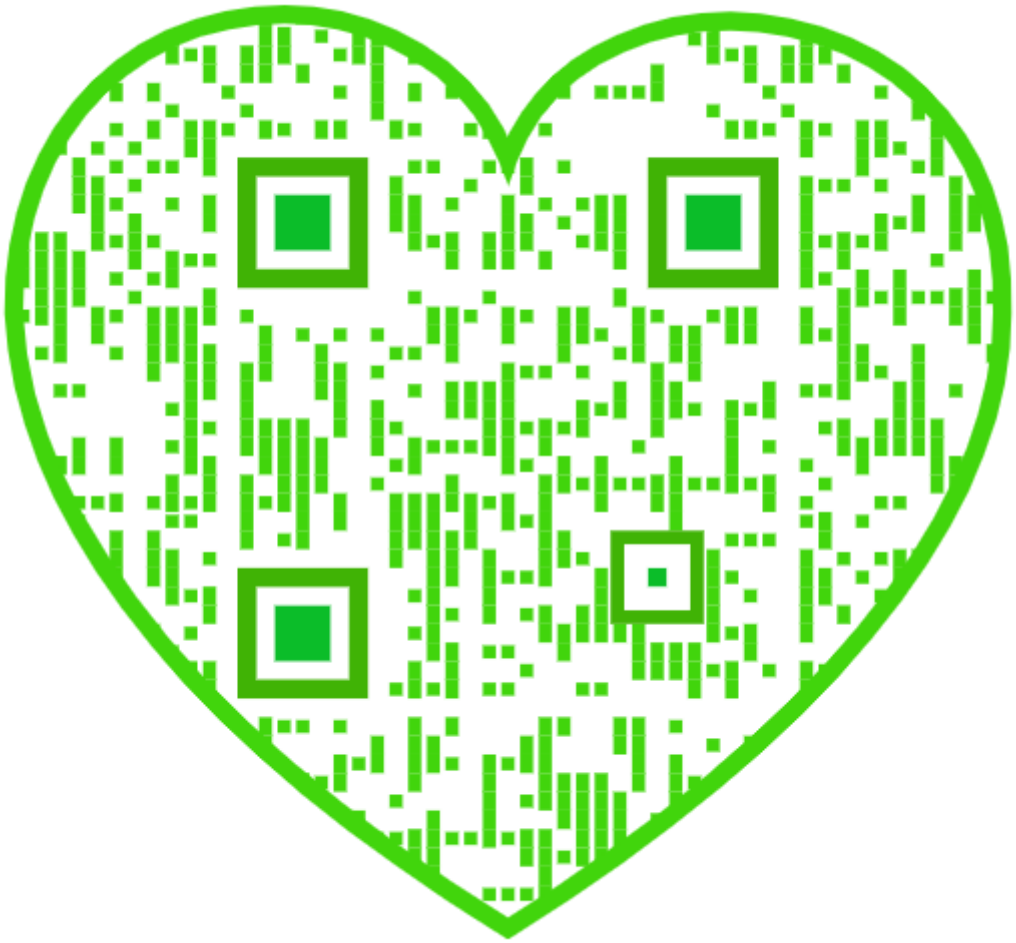

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NEW YORK, SATURDAY, JULY 22, 1899.

FLOATING OF THE "PARIS."

In spite of the fact that she had lain for fifty-two days on the rocks of the stormy Cornish coast and had fallen into such an apparently hopeless plight that her owners had abandoned her to the underwriters, the "Paris" has surprised everybody, including the salvage crews who were at work upon her, by suddenly sliding free of the rocks that held her. It seems that a Danish and two German salvage vessels were slewing the "Paris" around in order to assist the divers, when it was found that the good old ship was afloat. She was at once moved for several hundred feet until clear of the rocks, and early the next day was towed into Falmouth Harbor. Here it was found that the damage is much less than was suspected, the cabled reports stating that the largest hole in her bottom is only about three feet square. The keel and forward half of the bottom, which rested upon the ledge, are, of course, badly dented; but the main structure of the vessel does not appear to be overstrained. That this great ship of over fifteen thousand tons displacement should have stood this extraordinary test so well is a tribute to Mr. Biles, her designer, and the Clyde yard in which she was constructed a dozen years ago.

COMPARATIVE OPERATING COST OF HORSE AND ELECTRIC DELIVERY WAGONS.

A paper of very timely interest was recently presented at the general meeting of the American Institute of Electrical Engineers, on the subject of the comparative operating costs of horse and electric delivery wagons in New York city. The investigation, which was carried on during the past year in the city of New York, formed part of a graduation thesis in the Electrical Engineering Department of Columbia University, and the authors, G. C. Sever and R. A. Fliess, are to be congratulated on the careful method adopted and the practical value of the results obtained.

The method pursued was to gather together carefully recorded data of the hours of service, loads carried, and cost of operation, of both the horse-drawn delivery wagons and those electrically-driven, which are now in service at some of the large department stores in New York city. The paper, which is published in full in the current issue of the SUPPLEMENT, will be found to contain, in addition to the valuable comparisons above mentioned, some very interesting information regarding the elaborate delivery service which is maintained by all of these large institutions. The nature of this delivery service necessitates a highly organized system of delivery by means of small units capable of carrying from 700 to 800 pounds over short distances, and at considerable speed. Some of the wagons make two and some three deliveries a day, and the average load the year around is not over 800 pounds. As the return journey is seldom made entirely empty, the average load carried throughout the trip is about 500 pounds. The mileage per wagon per day is remarkably constant, as determined by means of an odometer placed on the axle of one of the wagons. To determine the average speed, one of the authors of the paper spent a number of days on his wheel following delivery wagons of many different kinds. His wheel carried an accurately tested cyclometer and also a carefully tested tachometer. The drawbar pull of the wagon was determined by the use of a traction dynamometer. It was found that the average pull per ton was 60 pounds on cobblestones at a speed of 7 miles per hour, and at the same speed the drawbar pull on asphalt was 40 pounds per ton. The average weight of the wagon, with its load and the driver and boy, was 2,075 pounds. The tabulation of the data shows that the average speed, while in motion, was 6·7 miles per hour, and the actual time that the horse was working from the time he left the stable until he returned to it, was one hour and thirty-eight minutes. The horse was at rest for nearly two-thirds of the time occupied by each trip. Taking the drawbar pull at 50 pounds per ton, it was found that the horse exerted 0·89 of a theoretical horse power for one hour and thirty-eight minutes. This was all the work done by this particular horse on this day. On the following day two trips were made over the same ground, and the average work per day, the year round, may be taken as not over 16½ miles at 50 pounds pull per ton, at a speed of 7 miles an hour. The length of the working life of a horse in this service is seldom over five years, and at the end of this time he has depreciated in value fifty per cent.

For comparative purposes the authors assume that the horse covers 21 miles a day in place of 16½ miles, and on this basis, taking into consideration the interest on the cost of horse and wagon, the stable rent for the same, the cost of driver and helper, etc., it was found that the cost of hauling one ton one mile was 17·373 cents. Taking another case where two horses are used to a delivery wagon, and three deliveries are made each day, the total distance covered being 42 miles, it was found that the cost under these highly favorable conditions per ton mile is 10·2 cents, the load in each case being taken to include the weight of wagon, driver, boy, and the freight carried.

The tests of electric delivery wagons were made over some 60 miles of the streets of New York, and included all conditions of weather and some of the heaviest grades in this city. The method of making the tests consisted in measuring the watt-hours of energy supplied by the storage batteries during the run and of taking the distance and speeds by tested cyclometers and tachometers. The first tests were made upon a vehicle intended for the delivery of light goods from a large drygoods store in New York city. A curious fact brought out in these tests is that the power consumption is not greatly affected by change of pavement, as from cobble stones to asphalt. The average of ten readings taken during a run of 13 miles in very bad weather gives the power consumed on asphalt pavement as, volts 85·3, amperes 23·1. In a run of 6·25 miles over a continually ascending route in which the total weight of wagon, passenger, etc., was 4,200 pounds the following results were shown: Average speed, 8·44 miles per hour; watt-hours per car mile, 218·28; watt-hours per ton mile, 103·95. Running in the opposite direction and with the grade the speed was 8·08 miles, the watt-hours per car mile 171·74, and per ton mile 81·08. From these and other tests it is deduced that 105 watt hours per ton mile is quite within the reach of actual practice under service conditions to-day, and under ordinary conditions a well designed electric delivery wagon should certainly not consume over 120 watt-hours per ton per mile.

On the above basis it is deduced that at a rate for power of 5 cents per k. w. hour, the total cost for 42 miles of one wagon, one driver, and one boy, including interest on wagon, interest on stable rent, etc., is 387·77 cents as against 428·54 cents for the horse-drawn vehicle with two horses as mentioned above. Hence the cost per pound of delivery is 0·017 cent less than the figures for the horse. But in connection with these figures it must be remembered that while the horse averages 21 miles per day at 7 miles per hour, the automobile covers 42 miles at the rate of 9 miles per hour. Hence the automobile can do the work of two horses in 1·34 hours less time with a saving of 40·75 cents per day on each 2,400 pounds of goods delivered.

THE WAGE OF ORIGINAL RESEARCH.

At first glance an announcement just issued by the United States Civil Service Commission appears to be of great interest to those of our young men trained in special scientific work, who very naturally look to the government as a principal employer of the scientifically educated.

On the recommendation of the Secretary of Agriculture the last Congress appropriated a lump sum to pay for the services of young men who might be appointed in the scientific division of the Agricultural Department, to be detailed at experiment stations. The Civil Service Commission was called upon to prepare an examination. As a result of the commission's labor the following has just been issued:

"The United States Civil Service Commission announces that it desires to establish an eligible register for the position of scientific aid, Department of Agriculture. The examination will consist of the subjects mentioned below, which will be valued as follows: College course, with bachelor's degree, 50; post-graduate course and special qualifications, 25; and thesis or other literature, 25.

. . . . . .

"Applicants will be limited to graduates of colleges receiving the benefits of grants of land or money from the United States.

"Each applicant must file with United States Civil Service Commission, Washington, D. C., a properly certified statement as to the length of time spent in college, the studies pursued, the standing in these studies, the special work it is desired to take up, and the special qualifications for such work, and, finally, a thesis upon such special scientific subject as the applicant may select, or, in lieu of this, any literature on scientific subjects published over his own signature."

So far, so good; although it must be plain, to those informed, that the selection of only those coming from institutions of learning that have called for or needed governmental subsidies will shut out many of the most capable young men from such an eligible list, as most of our great schools of science do not come within that category. However, this is not a matter of major importance, as the next two provisos in this most remarkable enactment completely shut out the very young men who, it is to be presumed, the government desires to employ in this scientific corps. These provisos read:

"The length of time any scientific aid may serve in the department is limited to two years.

"The salary shall not exceed $40 per month."

The stupidity of the first of these provisos, perhaps, rather exceeds anything of the kind that has yet emanated from Congress. Why a man who is at all worthy of employment as an investigator in economic science should at the end of two years—just when he must, by all ordinary reasoning, be reaching a fair degree of usefulness in his special work—be set adrift to find a new occupation, or, at best, a new employer, only an American Congressman can explain.

Even this blunder could be forgiven to men who, as a rule, regard such offices as these as only so many voters placated, if the utterly indefensible salary of "forty dollars a month" did not reduce the whole matter to an absurdity.

After the ordinary common school education, with four years of collegiate training and, perhaps, a year or two more of special post-graduate study following, the young man who finds himself on this eligible list enters upon his duties at a wage one-third less than that given a street-car conductor and fifty per cent less than that paid a laborer or door tender in the department in which he will be employed. After much patient toil at work, and after four years of arduous study, he will find himself dictating the results of his researches to a stenographer, receiving a salary almost twice as large, although only four or five months of training were required to fit her for that position.

When he was last in this country, the late Prof. Huxley said in an interview that the thing that most impressed him in the scientific world, on this side of the Atlantic, was the great benefits that the United States had derived and were deriving from the researches of its scientific men and the very low estimate that this country placed upon the labors of those very men. He pointed out that, in fact most, of our students in economic science at that time were men who as teachers, as lecturers, or as editors or authors, or in other fields of like exacting nature, were literally giving the products of their spare time to their fellow men for the love of science. He pointed out that, in a government like ours, it ought to be apparent to those who made the laws and held the national purse strings that no better investment of public funds could possibly be made than such as would look toward the encouragement and material support of the struggling student in science.

The life of the late Prof. C. V. Riley, long United States Entomologist, is a case in excellent point. Had Prof. Riley's salary been twice what it was, had it, in fact, been equal to that of a Congressman, and had he drawn it for every year of his life, the sum total would not nearly have equaled the value of the work he did, in the common interest, in the one field of grape culture and the introduction and propagation of Vedalia cardinalis. Yet that was but one of many lines of research, the valuable results of which Prof. Riley gladly and freely gave his fellow men the benefit of; and, thank good fortune and in spite of Congressional stupidity, the Rileys are still a goodly host in our scientific ranks.

A wage of nine dollars a week, with a two years' limit to the period of usefulness, is not the way to encourage original research and investigation, the benefits of which are to belong to the nation. An insect-spraying device, based on discoveries given by Riley to the agriculturists of this and other lands, is now bringing its "inventor" more per week than Congress considers the work of an investigator to be worth per month. The Biblical adage, "The laborer is worthy of his hire," is a true double entendre; he does, indeed, soon become worthy of it—and of no more! The man who finds that the government values his ultimate mental efforts in the public behalf at the per diem wage of a trench digger, if he be not one in ten thousand, is apt soon to agree with his employer and render him just the amount and sort of service paid for by that wage.

SPAIN SELLS CRUISERS.

At a recent meeting of the Cabinet Council of Spain, the Minister of Marine announced the sale of the Spanish cruisers "Patriota" and "Rapido" to the French transatlantic line and to a German steamship company. These vessels were formerly the "Columbia" and "Normannia," of the Hamburg-American line. They were purchased by Spain at the beginning of the late war and were converted into cruisers and renamed. They never took any active part in hostilities.

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ANIMAL TOOL-USERS, ENGINEERS, AND MECHANICS.

BY JAMES WEIR, JR., M.D.

Those who maintain that the lower animals, the sub-human families, in all manifestations of intelligence, are governed and directed solely and wholly by instinct, assert that such creatures never make use of tools. Yet, of these observers, even the most careless and most casual have, doubtless, time and again witnessed the use of tools by animals, though they may have failed to recognize it as such.

The spider which seeks out a pebble and anchors her web with it in order to hold it taut, or to keep it from being blown away by the wind, clearly makes use of a tool; the pebble in this instance is as much a tool as an iron anchor fashioned by the hand of man would be to human beings under analogous circumstances.

Prof. E. H. Webber, the famous anatomist and physiologist, writes as follows:

"A spider had stretched its web between two posts standing opposite each other, and had fastened it to a plant below for a third point. But as the attachment below was often broken by the garden work, by passers-by, and in other ways, the little animal extricated itself from the difficulty by spinning its web round a little stone, and fastened this to the lower part of its web, swinging freely, and so to draw the web down by its weight instead of fastening it in this direction by a connecting thread."

Not long ago I saw a spider use a broken nail as an anchor for her web. She had spun her trap in a square window in a partition wall. This partition stood between the saw room and the kiln or dry room of a planing mill, and the timber that was to be dried out was passed through the window from the saw room to the dry room. Of course, the lower stay rope of her web was frequently broken by the rafters, planks, etc., that was thrust through the window. The intelligent little architect soon evolved a method of suspending her web across the window without making use of a lower stay rope; she found a small fragment of a broken nail, and, by making use of an ingenious system of pulleys, in the elaboration of which she evinced high engineering skill, she finally drew the broken nail up to the bottom or lower margin of her wheel-shaped web, and there lashed it securely. The weight of the little piece of iron was sufficient to hold the web taut and to keep it stretched across the window.

Several years ago I saw a water moccasin make use of a novel method to secure its dinner. I was fishing in Ouachita River, Arkansas. One day, when I saw a large moccasin busily engaged in the pursuit of minnows, the current was so swift and strong, however, that the snake missed its aim whenever it darted out after one of these agile little fishes. Time and again it essayed to seize a minnow, only to be swept aside by the rapidly flowing water. Finally, it took a half turn of its tail about a bowlder, which rested on the bottom of the stream, and, when a minnow came within reach, it suddenly darted out its head and neck and caught the unwary little "silver sides." Here, so it seems to me, was deliberate ideation for a definite purpose, in which a reptile made use of a tool in attaining its object.

Several years ago I was greatly worried by black ants, which had discovered some specimens (bird skins) on a table, and which they had attacked and were removing piecemeal. I made four circles of tar on as many squares of brown paper and placed one of these squares beneath each leg of the table, so that the legs were encircled by the tar. This seemed to stop the ravages of the little thieves for several days, but eventually I again found them on the skins busily engaged in removing bits of flesh. On examination, I discovered that they had brought in grains of sand from the street and had constructed a bridge or dike across the tar with these miniature blocks of stone. So very wonderful was this intelligent act that I called in my friend, Dr. R. O. Cowling, professor of surgery in the University of Louisville, to witness it. I removed the circle which had been bridged by the ants and substituted a fresh square. We then saw the ants bring sand grains from the street and construct another bridge.

Reaumer, in his L'Histoire des Insectes, says that Cardinal Fleury told him that he saw ants on one occasion build a bridge of earth across some bird lime which had been spread on a tree; on another occasion the Cardinal saw these intelligent little architects build a floating bridge across a vessel of water surrounding the bottom of an orange tree tub. They used wood in the construction of this bridge, thus showing that they were aware of the nature of the material necessary to make their bridge a success; also, that they possessed no small engineering skill. Still more wonderful is the account of Dr. Ellendorf, who writes that the ants which he observed bridged a saucer of water with a straw. He had placed the legs of a cupboard in saucers of water, thus, for a few days, preventing the ravages of the ants. Finally, however, they again gained access to the cupboard and were as bad as ever. On examination, he found a straw in one of the saucers which lay obliquely across the edge of the vessel and touched the leg of the cupboard; the ants were using the straw for a bridge. "I now pushed the straw about an inch away from the cupboard leg," writes Dr. Ellendorf, "and immediately a terrible confusion arose. In a moment the leg immediately over the water was covered with hundreds of ants, feeling for the bridge in every direction with their antennæ, running back again and coming in ever larger swarms, as though they had communicated to their comrades within the cupboard the fearful misfortune that had taken place. Meanwhile the newcomers continued to run along the straw, and not finding the leg of the cupboard, the greatest perplexity arose. They hurried round the edge of the saucer, and soon found out where the fault lay. With united forces they quickly pulled and pushed at the straw, until it again came into contact with the leg of the cupboard, and the communication was again restored."

In this instance the ants were quick to seize on material ready to hand; they found in the straw a ready-made and most efficacious bridge. They clearly showed that they recognized it as such, by replacing it when the doctor moved it away from the cupboard leg.

Many of the lower animals evince great architectural and engineering skill in the construction of their domiciles, nests, etc., but, since this skill is for the most part the result of hereditary instincts, it will not be discussed in this paper. It so happens, however, that every now and then, sub-human creatures show by their actions that their engineering feats are the result of reason; that they are elaborated and inaugurated to meet the exigencies of immediate and utterly unexpected circumstances. Thus, on one occasion, where, owing to excessive heat, one of the combs of a hive became detached and was in great danger of falling, the bees at once set to work and built a shoring pillar between the endangered comb and the one next to it. This pillar kept the comb from falling. The intelligent little engineers then rebuilt the attachments of the comb with wax, thus firmly fixing it to the walls of the hive. When they had done this, they took away the shoring pillar and used the wax elsewhere. Each step in this engineering feat was witnessed by myself, and I was forced to acknowledge that man himself could not have met the accident more intelligently and warded off evil consequences more effectually.

Bees are firm believers in the adage "Cleanliness is next to godliness," consequently keep their hives spotlessly clean. They immediately carry out all filth and deposit it without the hive. Sometimes it happens that intruders, such as large moths, beetles, etc., in their wanderings stray into the domicile of a community of these exclusive little confectioners. At once war is declared, and the stranger is stung to death. The bees will remove the body if possible (and it is wonderful how strong they are and what heavy bodies they are able to move); if the dead stranger is too heavy for them, they will bury it beneath masses of propolis, a substance that they extract from the poplar and certain other trees. I once placed a large Polyphemus moth in a hive. The bees soon discovered the intruder, and an alarm was sent out. There was some confusion at first, but soon the brave little insects could be seen hurrying from all sides, and converging toward the invaded portion of the hive. Suddenly, the moths was attacked by dozens of bees, and was soon stung to death. They tried to drag the dead insect out of the hive, but, finding it entirely too heavy for their strength, they buried it beneath masses of propolis.

Some of the higher animals, such as the monkey and the elephant, on occasions, make as intelligent use of tools as men would under similar or like circumstances. A Capuchin monkey, which I owned for several years, was given some walnuts. He tried to crack the nuts with his teeth, but they proved to be too hard. He then seized a stone which happened to be lying near on the pavement, and, holding the nut with one paw, he brought the stone down on it with the other, thus effectually laying bare the longed-for kernels.

An Ateles, the property of Mr. Paul Devinney, of St. Louis, not only cracks nuts with a hammer, but also uses a "picker" in extracting the kernels. I have seen him do this time and again, and have often admired his skill and dexterity.

Some monkeys are fully aware of the properties of the lever and of the advantage of leverage. In 1882 I saw a monkey at the Fair Grounds, in St. Louis, Mo., which would pry apart the bars of his cage with a stick. When I gave him my cane, he would examine it carefully, as if mentally testing its strength; he would then place it between the bars at just the right spot, and swing back on it with all his might. When he had sprung the bars apart, he would squeeze through and "go on a prowl." Reugger, the German biologist and naturalist, describes a monkey which would "employ a stick wherewith to pry up the lid of a chest, which was too heavy for the animal to raise otherwise."

In 1889 there was on exhibition in New York a very large and intelligent hog-nose monkey. This animal was confined by itself, though there was a door between its cage and the one next to it. This door could be easily opened by the monkey, but a spring governed it in such manner that it would close unless held open. The hog-nose was a sociable individual, and was very fond of visiting its neighbors. It could not bear, however, having the door closed on it, thus shutting it out from its own particular domicile, so it evolved the ingenious trick of chocking the door with a pan whenever it went calling! It would open the door, then place the pan in such a position that it could not swing to!

One day I removed the pan, and the monkey's dismay and uneasiness was very plainly manifested until I restored it.

Elephants very frequently make use of tools. Sir John Tennant, Romanes, Dampier, and others say that these creatures, when passing through the jungle, break branches from the trees and use them as fans. One day, while observing Jessie, a very intelligent elephant that was on exhibition at the St. Louis Fair Grounds, I noticed that she was greatly worried and annoyed by the attacks of a swarm of large flies. These insects had settled on her back where she could not reach them with her proboscis or with her tail. She seemed to study the situation for a few moments; then, reaching out her trunk, she seized a mop-broom, which stood in the corner of her stall, and deliberately brushed off the greedy little bloodsuckers with it.

Mr. G. E. Peal states in Nature that he once saw a young elephant deliberately fashion a surgical instrument. He saw the animal in question go to a bamboo fence and break off one of the pickets; this picket it further fractured with its trunk and one of its fore feet until it obtained a sharp fragment some 10 or 12 inches in length. Then, leaning forward on one of its forelegs, it thrust this fragment, which it grasped with its trunk, into its "armpit" and vigorously moved it to and fro. As a result of this operation, a large elephant leech was dislodged, which dropped to the ground and was at once ground to mincemeat beneath the horny toes of the sagacious brute, which grunted its intense satisfaction!

Jessie, the elephant mentioned above, had some knowledge of pneumatics. One day I tossed a peanut which fell to the ground some 8 or 10 inches beyond the utmost reach of her trunk. She stretched out this organ to its fullest extent toward the peanut, then blew through it a sudden, quick, and powerful blast. The peanut was hurled against the wall, from whence it bounded and then rolled beneath the feet of the intelligent animal, which at once swallowed it. I tried this experiment several times, each time with a like result.

TIME OF TRANSATLANTIC PASSAGE AGAIN REDUCED.

The speed of the transatlantic steamship continues to advance by steady increments and the time of the ocean passage is curtailed hour by hour. That most successful ship, the "Kaiser Wilhelm der Grosse," of the North German Lloyd Company, has now, for the third time, surpassed the record formerly held by the "Lucania" for the highest average speed from New York to European ports. This mark stood for several years at 22·01 knots, and was first broken by the "Kaiser Wilhelm," which covered the course at an average speed of 22·3 knots, a performance which she subsequently eclipsed by achieving an average of 22·56 knots.

On her last trip the same vessel ran from Sandy Hook Lightship to Cherbourg in 5 days 20 hours and 55 minutes, the exact length of her course being 3,190 miles. To do this the "Kaiser Wilhelm" must have maintained an average speed, day and night, of 22·65 knots, or 26 land miles per hour. The most remarkable all-day run of this vessel was made in May, 1898, when during a westbound trip she covered 580 knots in one day at an average speed of 24·17 knots an hour. The best previous all-day run was that of the "Lucania," which covered 560 knots at an average speed of 23·33 knots.

BROOMS AS GERM BREEDERS.

Bacteriologists devote themselves to the detection, isolation, and destruction of bacteria, and strange to say, they do not appear to have given much attention to the danger that lurks in the ordinary articles of household use. For example, the common house broom is both the habitation and breeding place for whole colonies of bacteria, and cases of disease have been traced to this apparently inoffensive article. At Königsberg a course in bacteriology is given by a physician, in which he maintains that the strictest sanitary and hygienic conditions in things pertaining to the house should be inculcated, and in this country in the Boston Cooking School, and doubtless elsewhere, there are many lectures given on bacteriology. The refrigerator is one of the danger spots, for bacteriologists tell us that the minutest organisms may thrive even in melted ice, and putrefactive bacteria once gaining access to the household refrigerator will breed and contaminate butter, milk, meat, and other food kept therein. Cupboards and closets also afford an excellent breeding place for the ever-present microbe, and housekeepers will do well to look to such articles as refrigerators, brooms, dusters, etc.

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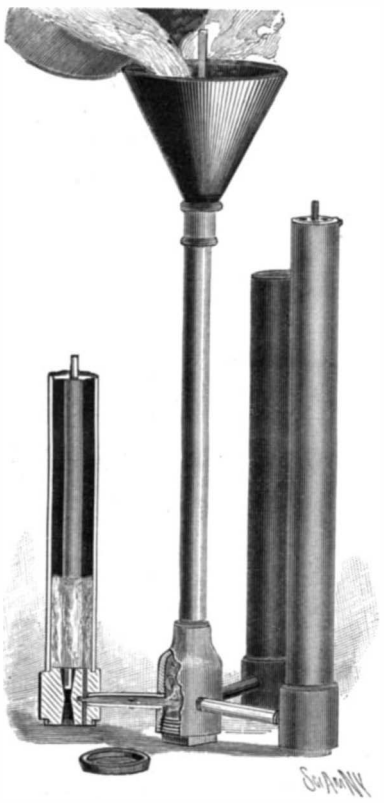
A SIMPLE MOLD FOR COMPOSITION ROLLERS.

The base-filling method of casting printing-press rollers is more desirable than the old method of top-filling, because it removes, to a large extent, the liability of flaws. A simple casting-outfit which employs the base-filling method and which is designed to meet the requirements of the average printing-establishment has been invented by Eugene Stough, of Sioux Falls, S. D. The combination-bases used in this device will cast three rollers simultaneously, an evident advantage if there be three sizes of presses using three sizes of rollers.

The combination-base at one end is turned to fit casting-tubes classed as "eighth medium," and the opposite end is adapted to fit tubes classed as "half medium." The intermediate size is produced by means of a ring or bushing whose inner diameter permits it to fit over the crown end of the base for the eighth medium size of tube, and whose outer diameter corresponds with the "quarter medium" tube. The base of each mold is formed with a longitudinal opening which contracts at the center. This opening receives the shank of the roller-stock, the contraction at the center facilitating the seating of the shank. Extending longitudinally through the base of each mold is a feed-orifice leading to both crowns and communicating with a feed-pipe. The various feed-pipes are connected with a central supply-tube surrounded by a funnel of sufficient capacity to enable all the molds to be filled simultaneously, a tapered wooden plug being used to close the outlet until the funnel has received its supply of composition and to control the feeding of the liquid mass. Caps are used to close the tubes when the composition has risen to the top. When set, the rollers are withdrawn in the usual manner.

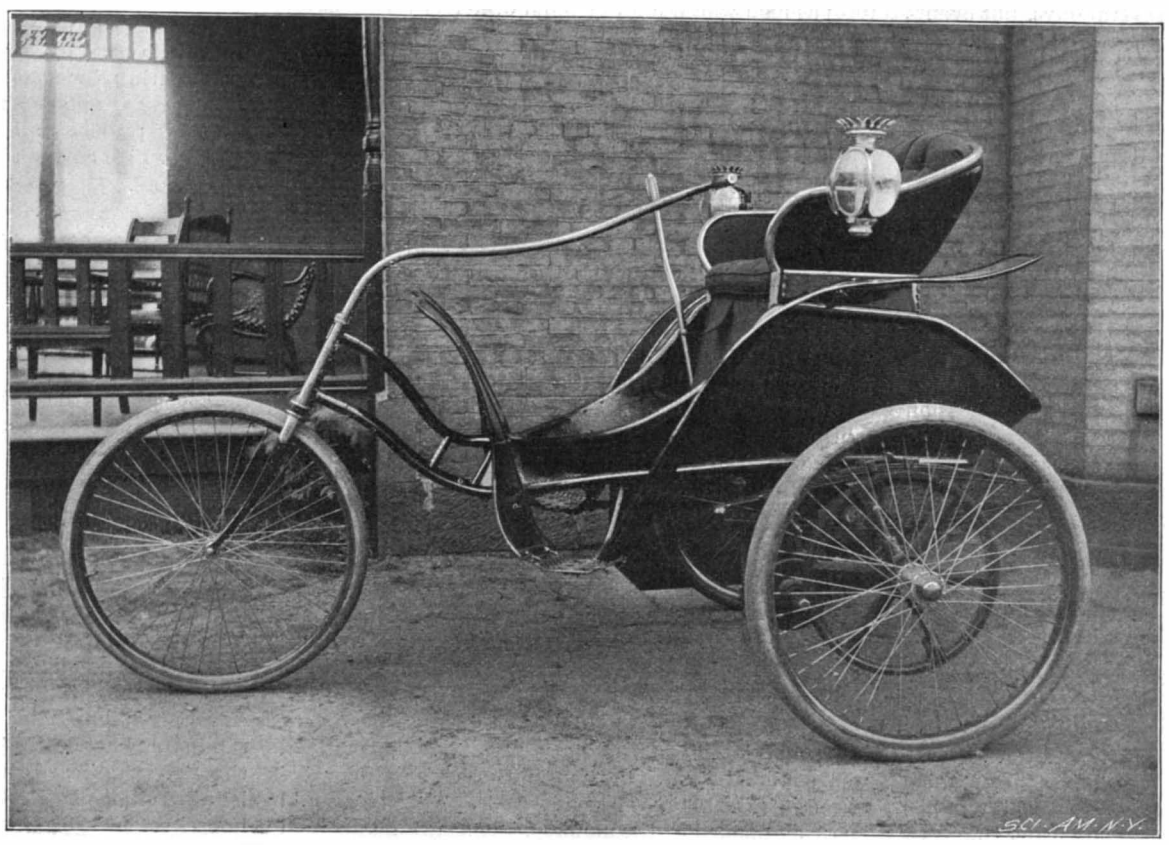


STOUGH'S MOLD FOR COMPOSITION ROLLERS.

THE EASTMAN "ELECTRO-CYCLE."

The Eastman "electro-cycle" is built along the lines of the bicycle, indeed, it might be called a "bicycle-carriage." In the words of its designer, "The bicycle was the principal incentive that has again inspired invention to solve the problem of self-propelled road vehicles, and must be the starting point in the evolution of the new automobile that is to come and stay. The bicycle, taken as a whole, embodies grace and completeness, yielding a maximum of speed with the expenditure of a minimum of power, and these features are eminently essential in the automobile."

The "Electro-cycle," shown in our engraving, was designed by Mr. H. F. Eastman, of Cleveland, Ohio. The frame is of steel tubing, the side panels of sheet steel, muffled and insulated, so as to be noiseless and practically indestructible. The construction admits of great rigidity combined with extreme lightness. The battery and motor weigh more than three-quarters of the total amount. There are three speeds forward, and one backward. Speed is regulated, the carriage reversed, and the coasting brake is applied all by means of one lever. There is also a powerful band brake applied by the foot. The steering is accomplished by handle bars and a steering head, as in the bicycle. Three wheels ride lighter and with greater steadiness than four, and also steer out of ruts and over car tracks with greater ease. It would appear that there is a considerable future for light vehicles of the kind we have described.



THE EASTMAN ELECTRO-CYCLE.

The Height of South American Mountains.

The results of the hypsometric measurements recently made, by Sir William Martin Conway, of the High Andes of Bolivia seem to determine definitively that Aconcagua, in Argentina, is the loftiest summit of the American Cordilleras, and accordingly the culminating point of the entire Western Hemisphere, says The Nation. Although this was the general assumption of geographers, the rival claims of the Nevado de Sorata and Illimani, which in the older geographies were represented to have altitudes respectively of 25,200 and nearly 24,000 feet, and even quite recently to approximate these heights, have left the question an open one. The present observations reduce these elevations to 21,710 feet (for the highest peak of the Sorata or Illampu) and 21,015 feet, a result strikingly in accord with that obtained by Minchin—21,470 and 21,224 feet—and about equally correspondent with that derived by the English geologist Pentland from his revised triangulation conducted in 1838, which gave 21,286 feet for the Sorata and 21,145 feet for Illimani. The absolute altitude of Aconcagua is, perhaps, still in doubt, but the measurements of Fitzgerald and Zurbriggen, made during their late successful and unsuccessful attempts to attain the summits, would seem to give the mountain a height fully equal to that which had been assumed for it by Fitzroy and Darwin, 23,200 feet, and about a thousand feet more than was claimed by the Spanish engineer Pissis (22,422 feet). The Sorata and Illimani now not impossibly also yield second place, as a number of summits, both in northern Chile and in Bolivia, are close competitors, and have at least the advantage of being reputed to be more lofty.

Trouble with Electric Cars in Corea.

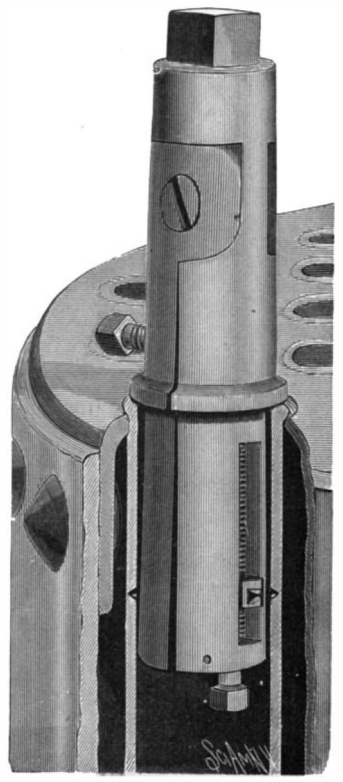
A young American, in the employ of the contractors of the Seoul-Chemulpo Electric Railroad, writes interestingly of the new electric road in Seoul, Corea. The road was well built, the cars coming from America and motormen were imported from Japan to run them. For some reason the fenders and gongs did not arrive, and this was the chief cause of the trouble. Those who were interested in the railroad insisted that the opening of the road should not be postponed, and, accordingly, the citizens were out in crowds to see "the devil wagon run by a wire." Soon after the car started, a child ran across the track, became excited, and was run down and killed. A mob soon gathered, which began to pelt the car with stones, and all on board fled for their lives. The car was torn to pieces and then burned. The wires were pulled down, but, fortunately, a serious accident was averted by turning off the current at the power house. Another car was sent out later in the day and met the same fate. A mob started for the power house, but was dispersed by the police. According to The New York Sun, Oriental advices state that twenty ringleaders of the rioters who destroyed the electric tramway cars at Seoul have been executed. The inhabitants of this strange land have been speculating for weeks on the cause of the drought, and many thought the electric wires cut off the influence of heaven. This probably accounts in a manner for the fanatic outbreak.

A SIMPLE TOOL FOR CUTTING PIPES.

In removing pipes or flues from boilers of the locomotive pattern a short piece is usually cut from the end of the flue in order to facilitate the work. A tool adapted for this use forms the subject of the accompanying illustration.

The tool comprises two hinged arms adapted to lie alongside of each other and to enter the pipe, each arm being provided with a collar to abut against the end of a pipe. The two arms can be adjusted toward and from each other by means of a set-screw passing through one arm and engaging the other. That portion of the one arm which enters the flue is formed with a slot in which a sliding block having a cutting-point is mounted. The block is perforated to receive a threaded bolt by means of which it can be adjusted in position.

In using the device the block is adjusted so that its cutting point is at the desired distance from the arm-collars. The set-screw previously mentioned is then turned until the two hinged arms are in contact. When the arms have been inserted in the pipe or flue, the set-screw is turned in the opposite direction until the cutting point of the slide block is in contact with the flue. The entire tool is then turned by engaging the squared end with a wrench. As the cutting proceeds the set-screw is gradually turned inward to force the sliding-block point deeper into the metal until the pipe has been severed.



FLETCHER'S TOOL FOR CUTTING PIPES.

The inventor of this implement is Mr. John Wm. Fletcher, of Tocapilla, Chile.

The Tuberculosis Congress.

One of the American delegates to the recent Tuberculosis Congress at Berlin, who has returned, is preparing a report for the Navy Department on the work of the Congress. Dr. Boyd considers that the results will be very important. The chief question which now interests the profession is the preparation of an effective serum to combat the disease. The most promising work is that of Dr. Behring, one of the most celebrated of the European specialists. He is pushing on his experiments as rapidly as is consistent with careful scientific work. The development of consumption sanitariums in Europe has also attracted much interest in this country. Preparations are now being made for the establishment of a consumption ranch in the high and dry region of the Southwest for the benefit of the merchant marine, in which there is a large percentage of consumptives.

Russia Purchases American Machinery.

Orders to the amount of $150,000 have just been placed with American firms for machinery ordered by the government of Russia for the temporary machine shops now being built at Harbin, Manchuria, on the Chinese Eastern Railway. It includes a 42,000 pound lathe, double axle lathes, boring mills, steam hammers, drills, etc.

THE Hungarian novelist Maurus Jokai is going to make an exhibit of his literary works at the Paris Exposition. It is said that he has written over three hundred books, and he will display his novels in every edition and in every translation that has been printed. It will undoubtedly be an interesting exhibit, though in rather poor taste.

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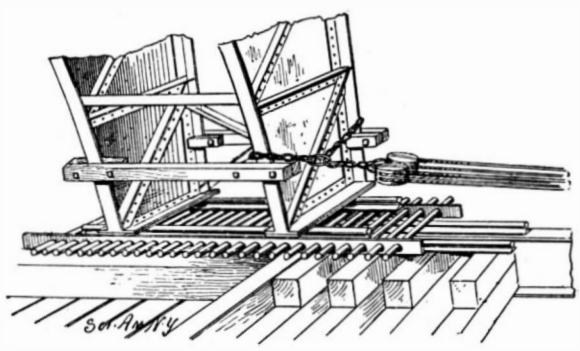
MOVING A 500-TON TRAIN-SHED ARCH.

An important enlargement and general improvement of the great terminal station of the Pennsylvania Railroad, Jersey City, has been under way during the past twelve months and is now nearing completion. This work, which had been contemplated for some time by the company, was hastened by a destructive fire which occurred in March, 1898, and destroyed the greater part of the waiting room, the restaurant and the dining room, together with the communications between the ferries and the station. The improvements have been chiefly in the direction of the enlargement of the existing ac-



DETAILS OF FOOTING OF ARCH AND NEST OF ROLLERS.

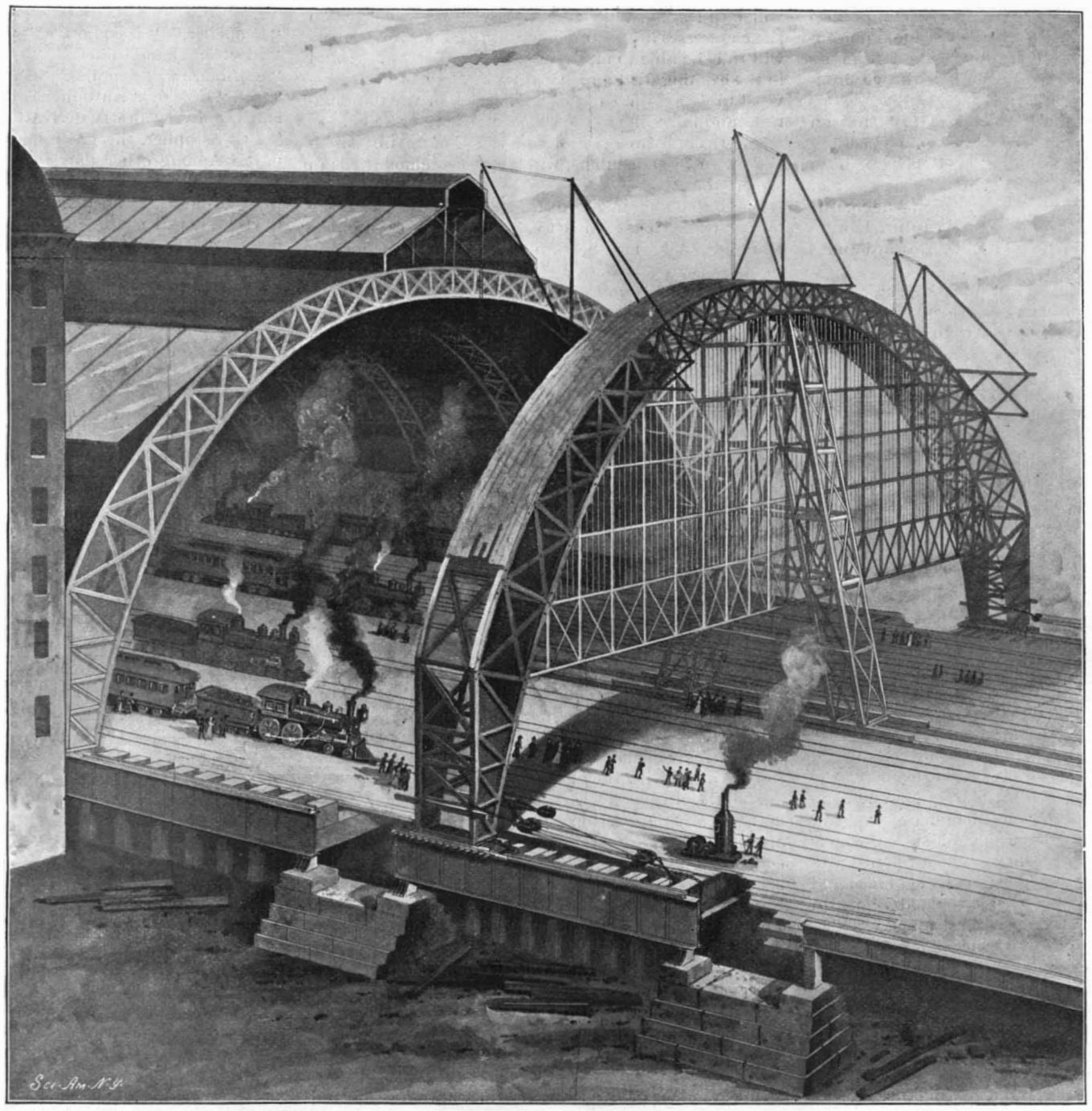
commodations, and one of the most important of these was the lengthening of the main train-shed by 125 feet, making its total length 777 feet. This lengthening involved the addition of two entire panels to the roof structure, and it was decided that the existing end or portal arch should be moved out toward the Hudson River a distance of 125 feet, and an entirely new arch built in its place with a new intermediate arch between the two. The portal arch is unlike the other arches of the roof, in that it is inclosed to form a gable for the end of the structure. All of the arches of the shed except the portal arches are provided with a system of heavy tie rods which extend beneath the railroad tracks and serve to resist the outward thrust of the foot of the arches. The portal arch has no such ties at the footing, but it is tied together by means of a truss which extends from hip to hip at a height of 30 or 40 feet above the tracks. The space above this truss is filled in with paneling of light steel-work which is glazed to keep out the weather. The trussed arch which was moved consists of two distinct trusses placed 14 feet apart and braced together. It is 256 feet in width and 114 feet in height, and its total weight as moved is about 500 tons.

The preparatory work consisted in building four new piers, two on each side of the shed, to carry the additional arches. These piers were built out in the river, upon piling which had been driven to a firm footing. The piling was cut off below water level, and the masonry piers were built upon it. To form a roadway over which to move the heavy structure, a bridge of piling and steel plate girders was built from pier to pier. On this was laid a floor of heavy timbers and two lines of ordinary steel rail. Upon the rails was laid a nest of parallel steel rollers of the kind shown in the accompanying small engravings, the rollers being similar in construction to those which are placed beneath the free ends of an ordinary railroad or highway bridge. Above the nest of rollers were placed two lengths of railroad iron, and upon these rested the foot of the steel arch. A heavy sling chain was passed around each foot of the arch, and powerful blocks and tackle were led from the structure to two stationary hoisting engines, one being stationed at each end of the arch.

The first operation was to cut loose the connections between the gable arch and the roof of the train-shed. It was then moved far enough to leave its own site clear for the construction of the new arch, to assist in which work the gable arch was utilized. It was then drawn forward until it was just beyond the piers for the intermediate arch, which was erected in a similar manner to the first arch. Finally the portal arch was drawn to its permanent position, 125 feet from the starting point.

As the great structure is 114 feet in height and presents a large area of wind, it is evident that a base of 14 feet does not present any large margin of stability against overturning by wind pressure. To guard against such a mishap, a couple of inclined legs or towers composed of heavy timbers were suspended from the girder and reached to within a few inches of the floor of the station. As it was clear of the ground, it offered no resistance to the movement of the arch, and at the same time fully precluded the possibility of an upset.

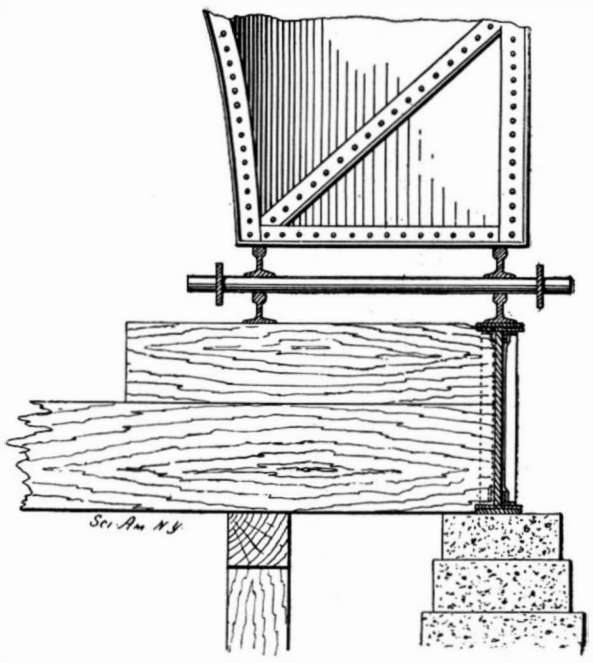
The whole work of the actual moving and construction of the new trusses has occupied about four weeks, and it has been carried through without any mishap. The plans for this work were drawn up by Assistant Chief Engineer Lewis H. Barker, who, together with the superintendent and contractors, is to be congratulated for the success with which they were carried through.



MOVING THE 500-TON GABLE ARCH OF THE PENNSYLVANIA DEPOT, JERSEY CITY.

Death in Headache Powders.

The daily papers have of late contained reports of death in various cities attributed to self-administration of unknown remedies. The other day a woman in Pittsburg died twenty minutes after swallowing a powder for the relief of headache. This is said to have been the fifth death, in that city alone, recently set down to the same cause. Such instances teach the nostrum-loving American people but slowly. The report of the physicians who have recently made an autopsy in the case of a lady of Detroit is said to show, says The Medical Record, that death was hastened by the use of secret headache powders. It would seem but right that the ingredients of all nostrums sold in the drug store should appear upon the package. This would protect in a measure both the druggist and the purchaser. When both are ignorant of what is being



SECTIONAL VIEW OF FALSE WORK OVER WHICH ARCH WAS MOVED.

administered, great damage may often result. Surely some legislation is called for.

Change in Russian Calendar.

Consul-General Holloway sends the following to the Department of State from St. Petersburg: The Russian government has, after many years' discussion, determined to abandon the old-style or Julian-Greek calendar, which is twelve days behind the now universal system of the Gregorian cycle, and which has been a source of annoyance to Russians doing business with other countries, who were compelled to use both dates, as well as to foreigners trading with Russia. The St. Petersburg Astronomical Society has taken the matter in hand, and with the cooperation of the ministers will appoint a commission, to be composed of sixteen persons, nine of whom are to be members of the Astronomical Society, who will arrange all the details. It is expected the new-style calendar will go into effect in 1901.

A $25,000 fountain is to be erected in San Francisco to commemorate Peter Donahue, the first foundryman, ship and railroad builder on the Pacific coast. There will be five bronze figures, each 8 feet high, and a punching machine 21 feet high, the whole group being emblematic of the early days of California mechanical industry. It remains to be seen whether or not the punching machine will be a discordant note in the group.

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The "Kissing Bug" Scare.

BY DR. EUGENE MURRAY-AARON.

The North Atlantic seaboard has recently had a visitation of insect poisoning, reaching from Richmond, Virginia, to Augusta, Maine, which has been treated to the usual newspaper exploitation and sensation mongering and has been dignified by the daily press with the sobriquet of "The Kissing Bug Plague." In the parlance of yellow journalism, the "kissing bug," which they would lead their readers to believe is an entirely new creature, presumably discovered by some enterprising reporter, is none other than the well known Melanolestes picipes, of the sub-family Piratina. Perhaps an occasional reader of these sensational accounts of serious illness and even of death from the "bite" of this insect has stopped to wonder how it has come that this species, with its death-dealing powers, has suddenly sprung into notoriety. If the mere puncture from its powerful proboscis is capable of such results, and the fondness for puncturing the human lips, from which it derives its newspaper name, is one of its principal characteristics, how does it come that, although known to science for nearly a century, its terrors have been left for this last year of the nineteenth century to disclose?

The "kissing bug" is no commoner this year than usual; of the genus Melanolestes, the two not uncommon species, M. picipes, with black, piceous legs, and M. abdominalis, with the sides and sometimes the whole upper surface of the abdomen red, are to be observed by the entomologist around electric lights in our parks, or in decayed matter, or under stones in our woods, with about the same frequency as always before. "They are active, blood-thirsty insects, and inflict a severe wound upon the hand of the incautious collector,"* has been said of them; although to describe them as "blood-thirsty" gives a false idea of a creature which, probably, never uses its proboscis on man for any purpose other than self-defense. There is no proof whatever that they are blood-thirsty, in the sense that that term may be applied to the mosquito. I have handled scores of both species, and have been bitten but once; and then only because I carelessly pinched picipes too tightly between thumb and finger, in lifting it from the ground to my killing jar. The wound made in my thumb was excessively painful, because my powerful little antagonist had no difficulty in piercing to the bone; but there was no more poison about it than about the puncture of a clean knife blade. For Melanolestes is not possessed of any virus or poison-secreting apparatus whatever; the occasional poisonous effects observed as following a wound from its proboscis are entirely due to the food or the environment it is lately from.

Its present reputation depends on the fact that an attaché of our Agricultural Department in Washington, and a gentleman in Wilmington, Delaware, both captured specimens of M. picipes in the very act of biting, and, in one of these cases, a slight degree of poisoning followed. The specimens captured were identified by U. S. Entomologist L. O. Howard and—the newspapers did the rest!

Since this took place in early June, the leading papers have reported about forty cases, so far as I have been able to find by recourse to a careful clipping service. In only three of these cases has Melanolestes been an undoubted offender; and in every one of these the pain of the puncture and a slight amount of poisoning in two cases is all there was of it. In five cases mosquitoes seem to have been suspected, and in four "an ordinary fly" was claimed to be at the bottom of the trouble. It is worth remarking, in passing, as a sample of newspaper disregard for anything approaching accuracy, that in several cases where the text refers only to a fly or a mosquito, the editorial headlines, or "scare heads," as they are technically called with unconscious humor, allude to the work of the "kissing bug," the "dread Melanolestes," etc., although there is no warrant whatever for such a charge.

There are certain facts mentioned in many other of the news items that clearly indicate to the pathologist the work of "a common fly." It is well known, of course, to all students of insects, that our common house fly, Musca domestica, is incapable of puncturing the human skin, and that its proboscis, a flabby, weak structure, is only adapted to sucking up juices, the human perspiration being, unfortunately for our comfort, a choice tidbit in the muscine menu.

There is, however, a second cousin of Musca, who is very differently armed, and whose well developed proboscis is both a sharp and quickly wielded lance and a powerful pumping tube, whereby blood is drawn up. This species, the "stable fly," Stomoxys calcitrans, while remarkably like the house fly, at first sight, may be distinguished from it by the manner of holding the wings rather more spread apart, when at rest, and by the more slender, straight and rigid proboscis. On close examination, also, the color pattern of the thorax will be seen to be quite different from any species of Musca. Stomoxys is a famous tormenter of cattle, well knowing the thinner points where their hides may be pierced, and it has for them, what it retains when attacking man, a fondness for easily reached surfaces of the mucous membrane. The inner curve of the lips being the most accessible point of that sort, it is well entitled by its fondness for biting in that locality to the name of the kissing fly. The larvæ of Stomoxys live in fresh horse manure, and the adult insect spends much of its time, according to its sex, in either sipping the moisture from that substance or in laying eggs therein. It thus comes that its habits hardly fit it for human and especially not for auscultory companionship. Fortunately, Stomoxys is not a very common visitant to our homes, although it is a species that is excessively common and multiplies by thousands. It prefers stables and cow yards, and only before heavy storms and late in the fall, when seeking shelter from cold nights, is it usually to be observed in dwellings. There is a great diversity of opinion among those who have rather hastily studied its habits, as to the danger of its bite, as there is of that of its near relative, Glossina morsitans, the celebrated and dreaded "Tsetze" fly of Africa, which is charged with frequently killing cattle. This difference of opinion is doubtless due to the fact that here, again, we have to do with a creature devoid of any poison of its own, but dependent on outside agencies for the troubles it occasionally causes. Hence it comes that one specimen, fresh from some germ-laden repast, carries disease, perhaps death, within its proboscis, while another, innocent of such infection, causes nothing worse than a temporarily painful puncture of the flesh.

* The Riverside Natural History, vol. 2, p. 281.

Some Features of the Paris Exposition of 1900.

Capt. A. H. Mattox, of the Bureau of Publicity to the United States Commission, Paris Exposition, speaking recently of the International Congresses to be held in Paris in 1900, said:

From June to September of the Paris Exposition of 1900 a series of International Congresses is to be held under the patronage of the French government. For their sessions a special Palais des Congress is being erected. It will contain one great hall for the public sessions and more frequented congresses. The foundations of this palace are being laid on the Quai de la Conference. The building will be erected two-thirds on land and one-third on water. The design is now well advanced, special care being taken with the vast gallery, over one hundred yards long and over twelve yards wide, on the Seine. The ceiling of this gallery will be in stained glass. All the chambers in which the congresses are held lead into the gallery. Members will thus be able to meet one another at all times; and in the evening distinguished visitors to Paris will be invited to witness from this immense hall the illuminations and fairy-like night scenes on the river Seine.

The twenty-three sections of the Congress of Medicine, with 7,000 members, will have accommodations in the city of Paris.

The French organizers of the different congresses are taking the greatest pains to add to the interest of the sessions. The membership card of the Charities Congress will admit to visits of the principal public and private charitable institutions of Paris, and the Congress of Medicine secures like advantages to its members. Personally, and in this case scientifically, conducted excursions of great interest and variety will be made by the Geologists' Congress. On the whole, the International Congresses are a special work of the Exposition; and every effort is being made to bring together in Paris for the occasion the leading representatives from every country of the contemporary movement in sciences, arts and letters, in education and philanthropy, and in commerce and industry.

The Paris Society of Musical Composers has organized a competition this year, for French musicians only, the subject being the composition for a full orchestra of an overture to be performed at the Exposition of 1900.

More varied and recreative, perhaps, will be the various elements provided in the Palace of Instruction and Education. Printing machines at work will relate the history of books and newspapers. The Mint will exhibit coining presses, and will coin in view of the public a souvenir medal of 1900, which visitors will be able to take away with them.

The Decorative Art Exhibits will be a great feature of the Paris Exposition. The exhibits of decorative art and all that pertains to furniture and domestic comfort will be displayed in the immense palace which is now being erected on the Esplanade des Invalides.

In the Palace of Chemical Products there will be a colossal paper manufactory, and in the Palace of Thread, Yards, and Clothing a collective exhibit of modern fashions, in which will be included a wedding procession, a Parisian soirée, and a fashionable luncheon. In the same group an exhibition of old French costumes will be displayed, in which will be shown a collection of ancient silks from Lyons which promises to be one of the art curiosities of 1900.

In the Palace of Civil Engineering, automobiles and cycles will occupy a surface of more that 77,000 square feet. Aerostatics will also be represented in this building. In the centennial museum of the transportation group, there will be a highly interesting display of all transportation methods employed during the past century.

French Agriculture will occupy the wing of the old Machinery Palace. In the four corners of the agricultural exhibition will be installed: a model flour mill, a model brewery, a model sugar refinery, and a model preparation room for Champagne wine. In the center of the square thus formed the centennial agricultural museum, including types of old French farms, will be located. Near the monumental staircase, adjoining the new Festival Hall, there will be a model dairy, a cider factory, and a distillery.

Automobile News.

Buffalo, N. Y., is now trying an automobile wagon for the collection of mail. The mail from forty boxes, covering a territory of six miles in length, was collected in less than half the time necessary to cover the same route with a horse and wagon. The experiment will be continued, and if it continues to work satisfactorily it is believed that a number of automobiles will be placed in regular commission in connection with the postal service in that and other cities.

By a series of drastic bylaws adopted at a town meeting on June 30, the automobile has been virtually prohibited from Bar Harbor. It is unfortunate that towns and cities should feel disposed to pass regulations of this nature before the new vehicles have done any damage or are even in use.

The automobile is gaining some victories even in large cities. In New York city they are allowed in all parks with the exception of Central Park; thus owners of these vehicles can now drive through the beautiful parks of Bronx and Prospect Park. The President of the commission has signified his willingness to ride through Central Park in an automobile and determine whether or not the vehicle would scare the horses. In both London and Paris there is no restriction, and automobiles circulate freely everywhere.

The question of a name for the automobile vehicles is still agitating many worthy persons who wish to air their latinity, and the result has been a collection of weird and impossible names which are amusing to say the least. Among them are "Carleck," "Careleck," "Electro-mobile," "Auto-carriage," "Autocab," "Autovic," "Autolau," "Autobus," "Autocam," "Autogen," "Propeller," "Locomotive," "Cabine," "Victorine," "Electric Landauines," "Ipsomotor," "Sineque," "Self-motor," "Mobiles," "Auto," "Autogo," "Molectros," "Molecs," "Autopher." The name last mentioned is really a very pretty derivation, being obtained from St. Christopher, the good saint's name being used in part. Among other particularly atrocious names are "Kinetic," "Autokinet," and "Autokin." It is to be hoped that if a short and really satisfactory name is devised, it will not be ugly, and will be, in a measure, descriptive.

The Peary Relief Expedition.

Prof. William Libbey, of Princeton University, has been appointed chief of the Peary Relief Expedition, to be sent out by the Peary Club, of New York, for the relief of Lieut. Peary in the Arctic regions. The steam bark "Diana" will be used for the trip and is now being fitted out at North Sydney, Cape Breton Island. The party will be made up of Prof. W. F. McClure, head of the Department of Biology; Arnold E. Ortman, Ph.D., Curator of Invertebrate Palæontology; and Charles F. Silvester, Preparator in Anatomy. With Prof. Libbey there are two representatives of the United States Coast Survey. The start will be made about July 17. The first object of the expedition is, of course, to take provisions and other supplies to Lieut. Peary. After the stores have been unloaded from the "Diana," the return trip will be turned into a tour for scientific explorations. Chiefly deep sea investigations will be carried on, and specially prepared dredging apparatus have been prepared. It is expected that the party will return about October 1.

The Transcontinental Automobile Trip.

Mr. and Mrs. John D. Davis started on their automobile trip across the continent on July 13. The start was made from the Herald Square, New York, and the first stop was at Tarrytown, where the occupants passed the night before proceeding on their journey. The carriage was escorted through the city by a number of automobile vehicles, and attracted much attention.

Work at the Watertown Arsenal.

Orders which have been received at the Watertown Arsenal will insure work for the entire fiscal year. The orders include twenty-one 6-inch gun carriages, twenty-three 7-inch siege mortar carriages, one 12-inch barbette carriage, two 10-inch barbette carriages, one 8-inch barbette carriage, three 8-inch disappearing carriages, besides a large amount of shot and shell of various calibers.

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Correspondence.

Electrical Destruction of Grass.

To the Editor of the SCIENTIFIC AMERICAN:

Your letter of June 12, inclosing a request from Mr. Wm. E. W. Yerby, Greensboro, Alabama, for information as to the feasibility of killing nut grass by electricity, has been received and referred to the Division of Botany.

Nut grass could doubtless be killed by a strong current of electricity, but it is very doubtful whether this could be economically applied in fields away from established electric light or trolley lines.

In 1895, Mr. Charles G. Armstrong, of Chicago, conducted some experiments in weed killing by electricity on the Yazoo Division of the Illinois Central Railroad. The results of the experiments were said to be successful, but I have been unable to learn that this method has been adopted elsewhere or continued there. The apparatus used for killing the weeds along the railroad track consisted of an alternating generator producing a current of 2,000 volts pressure, a transformer by means of which the current was stepped up to from 6,000 to 24,000 volts, and two brushes for applying the current to the weeds as the car passed slowly along the track.

An experiment on a small scale was also tried by Mr. Armstrong in killing weeds along a wagon road. The transformer and brush were placed in a hand cart, and the current was taken from a street car trolley wire. This was said to prove fairly successful, but I have no record of the kind of weeds killed or the condition of moisture in the soil at the time. In a trial of this method of weed-killing at the Michigan Agricultural College, it was found that while the tops of perennial weeds, such as Canada thistle, were killed, the roots in moist earth were uninjured. I have no record of the strength of current used in this instance.

It has been suggested that for field purposes an electric current could be conveyed by a cheap trolley wire on temporary supports from a regular trolley line or from a dynamo driven by a thrashing engine. The dynamo could be attached to a self-propelling engine drawing the transformer and brush, but the expense of working the rather dangerous and complicated apparatus would doubtless exceed the cost of eradicating the weeds by means of thorough cultivation, which would at the same time greatly improve the condition of the soil. Moreover, nut grass is propagated by underground tubers, some of which are borne at the ends of long, slender rootstocks several inches below the surface of the ground, and are surrounded by moist soil except during severe droughts. It would require a very strong current of electricity to kill these tubers, as the strength of the current would be dissipated as soon as it reached moist earth.

Nut grass may be eradicated in three years by any method which will completely prevent the development of any green shoots above the surface of the ground. Wide-tooth cultivators and hoes are among the best tools to accomplish this. Pigs that will root well are also used to advantage, and hens, geese or ducks confined over small patches of nut grass have been found effective in its extermination.

LYSTER H. DEWEY, Assistant Botanist.
United States Department of Agriculture.

Moving Pictures of Growing Plants.

The Agricultural Department is now making some interesting experiments, in which the moving-picture camera has been utilized. In one of their greenhouses the Division of Vegetable Pathology has an instrument of this kind in operation. It photographs the growth of a small oak tree. The machine works automatically, taking one picture per hour. At night the exposure is made by electric light. The camera has been running for two weeks, and in about two weeks the experiments will be discontinued. When the series of pictures is completed, it will be possible to reproduce upon the screen the growth of a plant from the time the first shoot appears above the ground until the tree is in full leaf and a foot or more high. Of course, this experiment has no very great scientific value, but it will be an important test of the capacity of the machine, which it is intended to use in watching the progress of plant diseases, blight, parasites, etc. If it is found that the experiments are successful, the agricultural colleges and experiment stations can receive positives which can be thrown upon the screen which will convey many important lessons.

The Expiration of the Eads Jetty Contract.

The Eads jetty contract, which was entered into by the United States with Capt. James B. Eads, in 1874, to keep a channel of at least 26 feet at the mouth of the Mississippi River, expired July 8. The Eads estate will be compelled, however, to keep the channel open for 535 days, in order to make good the number of days in which the water of the channel was under 26 feet. On the day of the expiration of the contract a ship drawing 26 feet 10 inches went through the jetties without touching bottom.

Miscellaneous Notes and Receipts.

To ascertain whether lumber is dry and sound, hold the ear to one end of the beam and have some one knock on the other end with a key. If the wood is all right, the knock can be heard distinctly, even if the beam is thirty yards long.—Maler Zeitung.

To Remove Rust Spots from White Linen.—Mix in a glass potassium oxalate, 5 grammes; lemon juice, 5 grammes; and salt, 5 grammes, with soft water, 80 grammes. Of the liquid obtained, put a little on the spots, then hold them to a tin vessel filled with hot water and heated thereby. The respective places are afterward washed with soap water. -- Praktischer Wegweiser.

Production of Belt Grease.—For the preparation of a semi-liquid belt grease, the Seifensieder Zeitung gives the following formula: Melt 6 kilogrammes of pinoline, 2·5 of fish oil, 5 of resin, 2·5 of wool fat, and add 1 kilogramme of gum solution and, with stirring, 1 kilogramme of tallow. Pour the mass into suitable vessels and continue stirring until cool.

Belt grease in sticks is produced as follows: Add to the above composition 10 kilogrammes of resin and 7 of ceresine. The tin shells used for shaping, which are provided with a stopper on one side, are placed in a vat filled with water, and the mass is filled into these moulds. After cooling, the stopper is taken out and the stick is pressed out of the tube. The sticks are next wrapped in tinfoil and packed in cardboard with label.

Hard Solder for Brass.—The Physico-Technical Imperial Institute (Physisch-technischer Reichs-Anstalt) has conducted tests with hard solders for brass, obtaining the following results:

The hard solders are known to consist mainly of copper, zinc, and lead or tin, sometimes with admixtures of cadmium or bismuth. Fifty-three hard solder alloys were tested, and it was found that the drawbacks which so many hard solders possess are due chiefly to the disparity between the brass of commerce and that of the small brass foundries, aside from the unequal and unsuitable composition of the solder material.

Hard solder of brass and zinc must only be prepared from the metal proper which is to be soldered.

The sharp line of the utility of the hard solder for brass lies in the mixture: copper, 46 parts, and zinc, 54 parts. Such a solder, however, though sufficiently malleable on the whole, is too hardly fusible for general use. By the addition of 3 per cent of tin, it is true, the fusing point is lowered, but the malleability is practically suspended, thus making the durability of the soldering doubtful. Admixtures of slight quantities of readily fusible metals have only little influence upon the lowering of the point of fusion; but as soon as they are added in such amounts that the fusing point goes down considerably, the malleability is arrested in every case.

Cadmium is entirely unsuitable for the production of readily fusible hard solders, since it causes them to oxidize strongly in the fire and consequently to fuse very sluggishly.

As regards malleability, ready fusion, and good behavior during the melting, only one hard solder remained of the fifty-three tested; same contains, besides copper, only zinc and silver. In conformity therewith the Imperial Institute has determined on the following composition as being practical:

a. Of good fusion: Copper, 48 parts; zinc, 48 parts; silver, 4 parts.

b. Of ready fusion: Copper, 43 parts; zinc, 48 parts; silver, 9 parts.

c. Of quick fusion: Copper, 38 parts; zinc, 50 parts; silver, 12 parts.

The property of being thinly liquid, of these solders, as well as their malleability, is not attained by any other solder; the latter property even excels that of the best copper-zinc solder twice over. They do not turn black in pickling, like all readily fusible hard solders containing tin and zinc, but are characterized by a pleasant, gold-like color, so that goldsmiths and jewelry manufacturers may also use them with advantage.

According to the Imperial Institute, the Ulm Brass Works are now manufacturing hard solders which are sold in the market as silver hard solders 1, 2, and 3. In order not to have the points of fusion lie too closely together, the said firm has given its silver solders the following composition:

1. Copper, 50 parts; zinc, 46 parts; silver, 4 parts; of good fusibility.

2. Copper, 43 parts; zinc, 48 parts; silver, 9 parts; of ready fusibility.

3. Copper, 46 parts; zinc, 52 parts; silver, 12 parts; of quick fusibility.

For general use in workshops, but especially for wholesale manufacturing, solder No. 2 is the most commendable. No. 1 is suitable for first soldering, while No. 3 is destined for third soldering, and is to replace all quickly fusible hard solders containing tin and much zinc. The slight increase in cost caused by the utilization of silver is amply counterbalanced by secure working and time gained.—Journal der Goldschmiedekunst.

Science Notes.

Oxford University has conferred the degree of D. C. L. on Prof. Simon Newcomb.

Charles Darwin's statue, the gift of Prof. Poulton, has been put in the Oxford University Museum next to the statue of Sir Isaac Newton.

The Clyde shipbuilding returns for the year just ended show that 125 vessels were launched, representing an aggregate tonnage of 234,877.

Lord Salisbury is an ardent chemist, and has announced that he has discovered an important chemical process at his laboratory at Hatfield House, and that he will communicate the same to the world at a forthcoming meeting of one of the learned societies.

On the Fourth of July 1,500 pounds of red and blue fire were burned on the summit of Pike's Peak at an altitude of 14,143 feet. The affair was really a State one, and trainloads of people were brought to witness the event. The illumination was plainly seen at Denver, 75 miles to the north, and at Pueblo, 45 miles to the south.

The Board of Health in New York was recently surprised to learn that a restaurant was being conducted in Washington Cemetery, which lies between Gravesend and Coney Island. The Board of Health considered it rather extraordinary that there should be a restaurant in the cemetery and strange that people should go there to eat. The place has been inspected and condemned.

Iced chloroform, according to The Medical Times, has been used as an anesthetic in Prof. Shorburg's clinic in the Julius Hospital at Würzburg, Bavaria, in over 14,000 cases without a single unpleasant result. The advantages claimed for this preparation of chloroform are the quickness of its action, its comparative freedom from danger and the absence of the nausea and depression so common with other anesthetics.

Raphael's Sistine Madonna, which is one of the most beautiful paintings in the world, has been recently attacked by a young German critic named Jelinck, who attempts to prove that Raphael never painted the picture at all, and that it has been extensively restored. The latter is undoubtedly true, but the painting itself is an arch-authenic work of the Urbinate master. It is believed by critics that the painting was really intended for a processional banner. This view is based on the texture of the canvas.

A favorable account is given in The Scottish Geographical Magazine of the economic condition of German East Africa. The trade is steadily on the increase, which is largely in consequence of the fact that the government has constructed nearly 800 miles of railroad for wheel carriages. The principal products are tobacco, sugar and coffee. The exports for the year 1897-98 were nearly three times as great as those of the previous year, notwithstanding the fact that the coffee plant suffered great injury from drought and locusts.

At the present time it is hard to say what will or will not be built as an attraction at the Paris Exposition. Novelties of all kinds have been suggested, but most of them have not been approved of by the authorities or they have been abandoned owing to financial reasons. The latest project is a representation of Pompeii as it appeared before its destruction A. D. 79. Archæologists and artists have warmly approved of the attempt, and the Italian Minister of Fine Arts has promised to give all possible aid in insuring accuracy. The time is now very short in which to produce any satisfactory work.

Howard J. Rogers, Director of Education and Social Economy to the United States Commission, Paris Exposition, speaking of the educational exhibit of the United States, said: "It is impossible to estimate how many sections of the country will be represented in the educational exhibit, but he thinks there will be from sixty to seventy-five. The cities which have made adequate appropriations, and which will be represented completely in all departments from the kindergarten to the high school, are Boston, New York, Newark, Albany, Chicago, St. Paul, Omaha, and Denver. Many other cities are preparing work in special ways, or to illustrate special features. The educational exhibit will be distinctly national in form, although all material contributed by any city or State will be properly credited to that locality. The effect is to show, irrespective of State lines, the best and most advanced work which is being done in every grade of public school work, and in college and university departments in the United States. To accomplish this the exhibit will be arranged by grades, so that in examining one can find in one section all the primary work of each country, in another all the grammar school work, and so on. In the department of higher education the same scheme will be followed, and instead of a certain definite amount being assigned to the greater universities, the space is divided in nine departments, viz., law, medicine, theology, pure science, philosophy, language and literature, fine arts. All of the great universities of the country are preparing exhibits in two or more of these departments as they choose."

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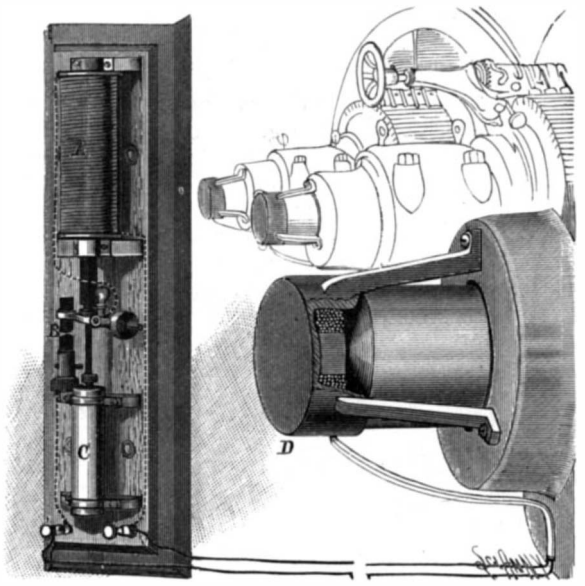
NIAGARA FALLS POWER PLANT.

The two preceding articles on Niagara as an industrial center, published in our issues of May 27 and June 17, dealt respectively with the general topographical and physical features of the Falls, and the many remarkable bridges which span the Niagara gorge. We now take up the subject of the industrial development of the water power. In its present stage this great work has been almost exclusively carried out by two companies, whose methods of utilizing the great hydraulic head presented by the Falls are so different, and include such elaborate and highly interesting plant, as to defy any adequate illustration or description in a single chapter. The present article will be devoted to the larger of the two plants, which is known as the Niagara Falls Power Plant and is situated on the American side at a distance of about a mile above the Falls.

The total fall available for power purposes between the river above the upper rapids and below the falls is 216 feet. This has been utilized on two different plans. The Niagara Falls Power Company has placed its turbines at the bottom of a huge wheel pit, 180 feet in depth, and excavated a great tunnel 7,000 feet in length, which acts as a tailrace to carry the water from the bottom of the pit to an outlet below the Falls. The available head in this case is 136 feet, measured from the surface of the company's feeder canal to the center of the turbines. The other company, known as the Niagara Falls Hydraulic Power and Manufacturing Company, conducts the water through the town of Niagara by an open canal, to a basin at the edge of the gorge below the falls, from which it is carried by large penstocks down to the turbines which are located in a power house at the base of the cliff, and a few feet above the level of the lower river. The available head in this case is over 200 feet.

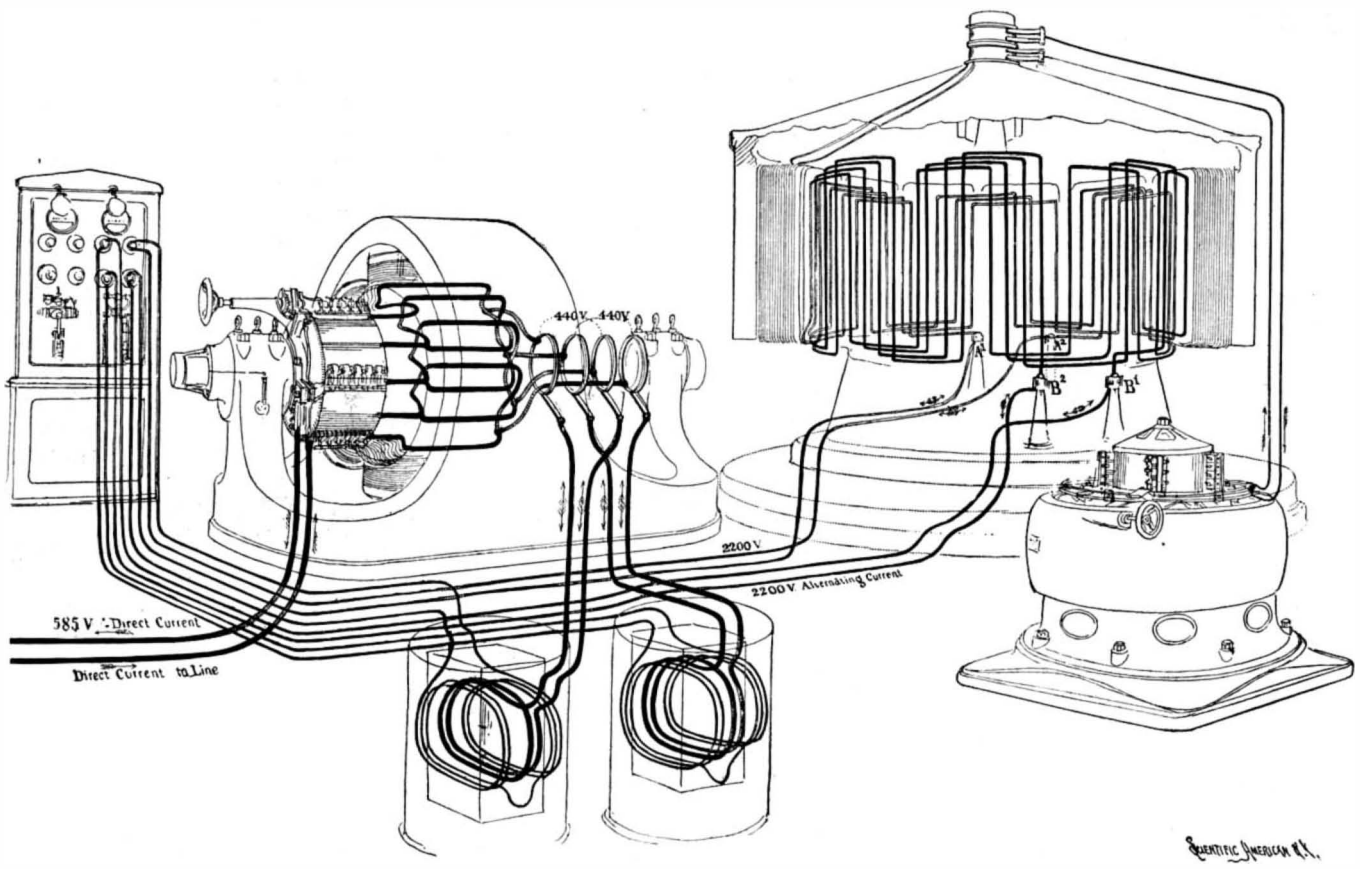
The water is led from the upper river to the power house of the Niagara Falls Power Company by a short canal which is 12 feet deep and is of sufficient capacity to supply water for the development of 100,000 horse power. The scheme as completed calls for a power house extending along each side of the canal, each containing generators capable of a total output of 50,000 horse power. At present only one power house has been built, as shown in our front page engraving, with designed capacity of 50,000 horse power, of which 40,000 horse power is already installed. Below the floor of the house has been excavated a great rectangular wheelpit 20 feet in width, 330 feet in length and 178 feet deep. Leading from the canal to the bottom of the pit are eight steel penstocks, each nearly 8 feet in diameter, which deliver water under a 136-foot head to eight 5,000 horse power turbines, which were designed by Messrs. Faesch & Piccard of Geneva, Switzerland, and built by the I. P. Morris Company, of Philadelphia. These designs were chosen by the company from a number of competitive plans sent in by the most prominent hydraulic engineers of the world. Each wheel is made up of two Fourneyron vertical turbines, one inverted above the other, with a view to getting rid of excessive weight upon the bearings. Weight is neutralized by admitting the water from the penstock through the disk of the upper guide wheels, so that it may exert a vertical thrust upon the disk of the upper turbine wheel. When running at 250 revolutions per minute, each turbine develops 5,000 horse power. As will be seen from the front page engraving, the wheel-pit extends beneath the floor of the power house for its full length. From each turbine there rises a vertical shaft, which for the greater part of its length consists of a steel tube 38 inches in diameter with a shell ¾ inch in thickness. The upper portion of the shaft is of solid steel and is 11 inches in diameter, and at the top of this is carried the massive revolving field of a 5,000 horse power generator. The turbines are built upon a bottom platform of massive steel girders placed at a depth of 146 feet below the surface of the canal water; and three sets of girders which span the wheel-pit at regular intervals serve to carry steadying bearings for the vertical shaft.



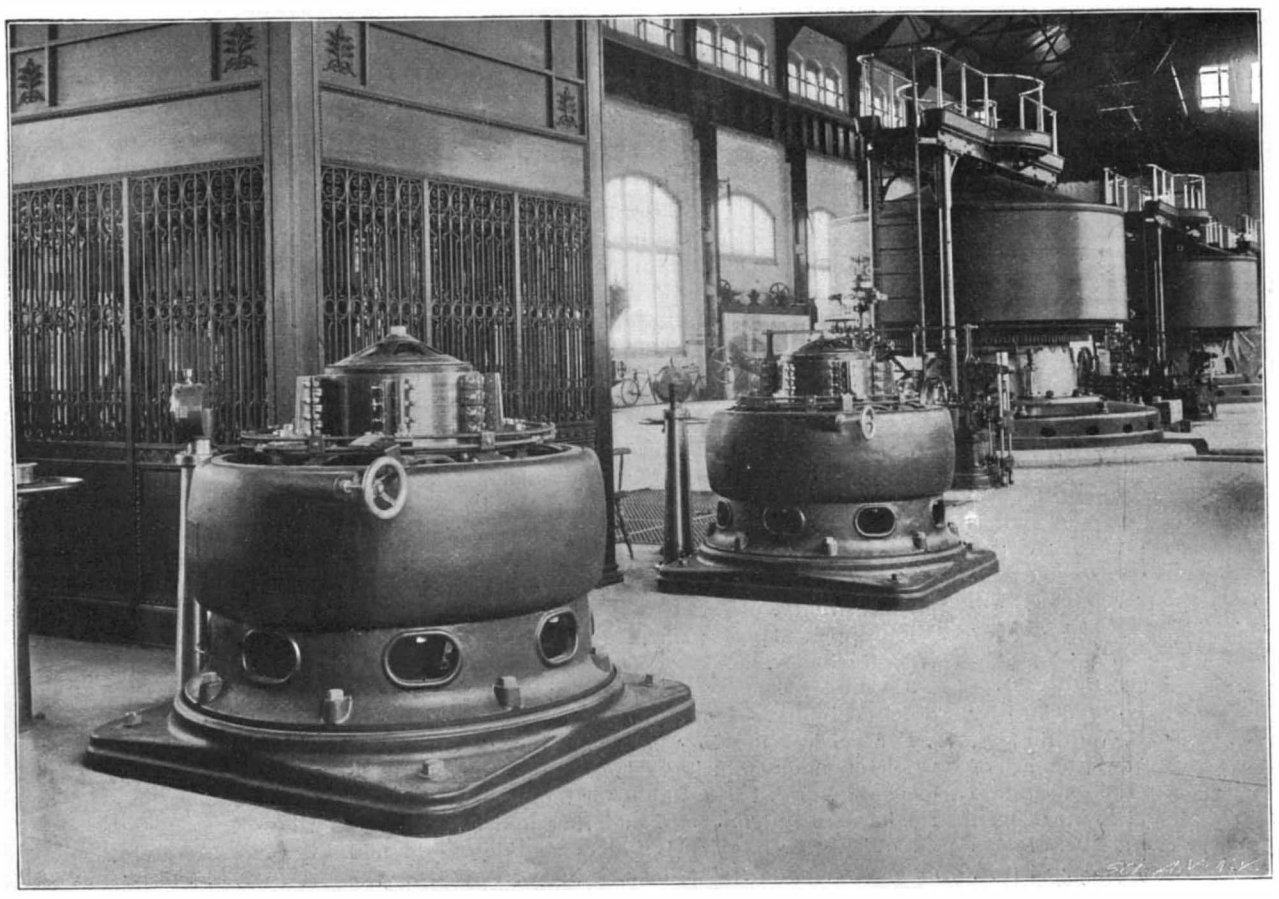
4.—Automatic Attachment for Securing Even Wear on Commutators and Journals.

The great generators, of which there are eight, are placed vertically over the turbines, and rest partly upon the floor of the power house. The armature is stationary and is carried upon a massive conical casting, which is bolted to the arched roof of the wheel-pit, the top of which is level with the power house floor. The rotating field-ring is attached to the main shaft by means of an umbrella-shaped disk, and rotates in a horizontal plane around the armature. The field-ring is a solid ring of nickel steel, 11 feet 7⅛ inches in outside diameter. It carries on its interior face 12 field poles, each with its winding weighing 2,800 pounds. The weight of each generator is 85 tons, the revolving field alone weighing about 40 tons.

Two systems are in use for governing the turbines. The first three are controlled by Faesch & Piccard hydraulic governors which act directly through a walking-beam upon the gates. The other five turbines are controlled by electrical governors, which are so arranged that when the voltage falls, a magnetically-operated clutch closes and serves to raise the gate. The pole-pieces of the field are supplied with 220-volt current supplied by the two generators shown in the foreground of Fig. 6. The current is led to the rotating field by way of collecting-rings at the top of the rotating disk, as shown in the diagram of the wiring, Fig. 5. These two exciters serve all of the main generators.



5.—Diagram of Wiring of Main Generators and Static and Rotary Transformers.



6.—Generators for Exciting Fields of Main 5,000 Horse Power Generators.

NIAGARA FALLS POWER PLANT—III.

We draw particular attention to the large photographic view of the interior of the power house as something quite unique in its way, for here we see represented the generation not only of the largest aggregate of electrical horse power, but the largest aggregate of any kind of horse power, now being developed under one roof and in one room anywhere in the world. The nearest approach to it is the engine room of the steamship "Campania," where 30,000 horse power are given out on the propeller shafts. It is true the great traction companies in New York are building and planning stations whose total output will be 70,000 to 100,000 horse power, but just now the splendid power house here represented has the greatest capacity of them all. The point of view of the photograph is the visitors' gallery, and one receives a vivid impression of the compactness and general

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convenience of electrical generating machinery when he bears in mind that each of those swiftly rotating machines, any one of which could be placed within the walls of an ordinary cottage living room, is generating the enormous total of 5,000 horse power. Around the roof of each rotating field is arranged a series of hoods which serves to catch the air and cause a draught of cold air to pass through the generator. The hazy effect caused by the swift rotation of these hoods is noticeable in the illustration.

The enormous two-phase 2,200-volt currents from the

ALESSANDRO VOLTA.
From an engraving by Morghen.

generators are led to a special switchboard, operated entirely by compressed air, on which a panel containing an ammeter, wattmeter, and voltmeter for each phase and a direct-current ammeter in the exciter circuit, is provided for each main generator. On the opposite side of the canal from the power house is a smaller building, which contains the transformers, a covered passageway between the buildings serving to carry the mains. It is impossible within the limits of this article to describe in detail the various transformations of the current which are made to suit the needs of the various users. The diagram, Fig. 5, showing the wiring of the main generators, and also of the static and rotary transformers in which the current for the Niagara Falls railways is converted to direct current, will be of interest. The 2,200-volt two-phase current from the main generator is transformed by a static transformer in each phase to 440-volt current, and then led to a rotary transformer, where it is changed to 550-volt direct current for use on the local street railways. Of these the Niagara Falls and Suspension Bridge Company takes 250 horse power and the Buffalo and Niagara Falls Electric Railway 350 horse power. Perhaps the most interesting transmission is that of 6,000 horse power to Buffalo, twenty-six miles distant. The current for this purpose is stepped up from 2,200-volt two-phase to 11,000-volt three-phase in two huge static transformers located in the transformer building. These have been so arranged that by a change of connections the pressure may at any time be raised to 22,000 volts if it should be deemed advisable.

The company owns a continuous tract of land which includes two miles of river water front, and embraces over a thousand acres. Located upon this and other adjacent property are a large number of electro-chemical establishments which have been attracted to the locality. The names of some of these concerns and the horse power they are receiving from the Niagara Falls Power Company are as follows: Union Carbide Company, 6,000 horse power; Pittsburg Reduction Company, 3,600 horse power; Carborundum Company, 1,100 horse power; Mathieson Alkali Company, 2,000 horse power; Niagara Electro-Chemical Company (sodium), 650 horse power; Oldbury Electro-Chemical Company, 500 horse power; Buffalo and Niagara Falls Electric Light and Power Company, 800 horse power. Altogether the company is supplying over 22,000 horse power, and it is now under contract to supply 20,000 additional horse power for various purposes. Two additional 5,000 horse power wheels are now being installed, so that before long the present power house will have reached its designed capacity of 50,000 horse power.

In addition to its sale of electrical power the company supplies 7,200 hydraulic horse power to the Niagara Falls Paper Company, whose large establishment is located near the power house. The water received from the power company is utilized by the paper company in turbines located in its own wheel-pit, which is connected with the main tunnel tailrace by a branch tailrace 7 feet in diameter.

The visitor to this splendid plant is impressed with the great care that is taken to keep everything up to the highest state of efficiency, a care that extends to the smallest details. We present a cut of an attachment designed by the chief electrician, Mr. P. M. Lincoln, for securing an even wear on the commutators and also on the journals of the generators, converters, etc. It consists of an electro-magnet, *D*, which is held by means of three legs bolted to the frame of the generator, outside one end of the armature shaft, and a current interrupter which may be placed in any convenient corner of the building. The object of the device is to give the shaft a continuous reciprocating motion in the direction of its axis so as to prevent irregular wear in the brushes and journals. When the magnet, *D*, is excited the shaft is drawn outward, and when it is demagnetized the shaft returns by the attraction of the field on the armature. When the coil, *A*, of the interrupter is excited it lifts its core, trips a small weighted lever, and breaks the contact at the carbon points, *B*, when the coil is demagnetized and the core and arm drop, the fall being retarded by a dashpot, *C*. The device is giving good results on the machines to which it has been attached.

It will be remembered that when the Niagara Falls Power Plant was first set in motion, there was a confident prediction by the press that before many years the energy of the Falls would be transmitted electrically to cities that were 100 miles or more distant. The statement was not generally indorsed by expert opinion, and it is significant that the tendency to-day is for the manufacturers to locate at the Falls rather than for the power of the Falls to be carried long distances to the consumer. Although the current, in the present state of the art, could probably be transmitted for 100 miles with a loss in transmission of less than 20 per cent, it would cost so much more to the consumer as to render the erection of works at Niagara a more profitable alternative.

ALESSANDRO VOLTA.

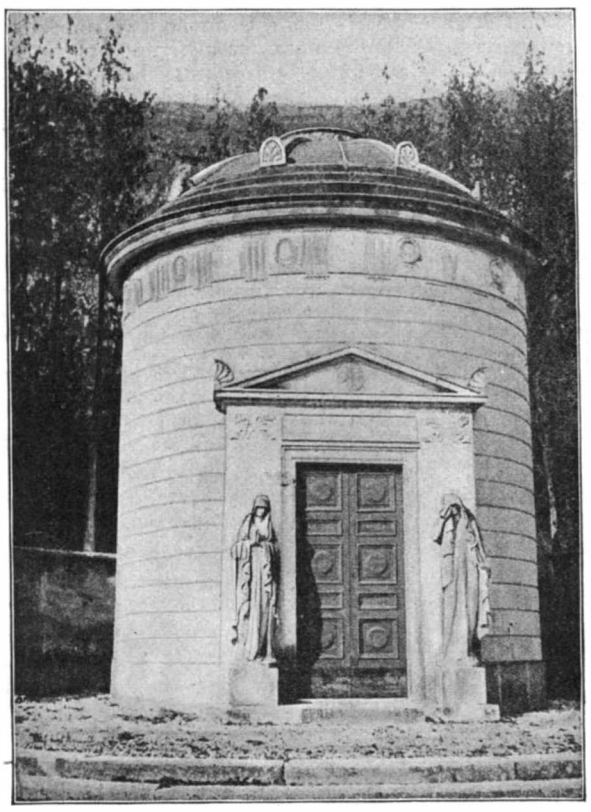
The hundredth anniversary of the invention of the electric battery by Volta was celebrated by an International Electrical Exposition at Como, which was opened with due ceremony in the presence of the King of Italy, on the 20th of May, and certainly no more fitting tribute could have been paid by the people of his native place to its most illustrious citizen.

The Volta Electrical Exhibition at Como, Italy, including the many relics of Alessandro Volta, was entirely destroyed by fire on July 8, the cause being a defective electric wire. The fire broke out in the marine gallery, and spread with marvelous rapidity, owing to the combustible nature of the buildings and their contents. Many visitors were in the buildings, and they fled in a panic. Two gasometers exploded, adding to the disaster. No lives were lost, but many exhibits and scientific records, which cannot be replaced, were burnt.

The Volta relics were contained in a receptacle built of solid masonry, but, notwithstanding this fact, they were all destroyed with the exception of some of the personal effects of Volta, including the Senatorial sword presented to him by Napoleon, and his decorations. Fortunately, we are enabled to present engravings of a number of the interesting exhibits. The illustrations were published originally in our esteemed Italian contemporary, L'Illustrazione Italiana.

Volta was born at Como, on February 18, 1745, in the house that was occupied by the Volta family for 326 years. His father was Filippo Volta, who wasted his patrimony by imprudence and prodigality, and his mother was Countess Maddalena Inzaghi. He had three brothers and three sisters; all of the former were connected with the church, and two of his sisters were nuns, but the third married Count Reina. The first two years of his life Alessandro spent in the house of his nurse. He developed so slowly, intellectually as well as physically, never speaking a word, that his parents feared that he might be a mute, until one day, when he was four years old, he uttered an emphatic "No." Afterward his progress was rapid, and even in childhood he manifested a passion for observing natural phenomena and investigating their cause, and this propensity very nearly cost him his life, for one day, when endeavoring to find something, which he supposed to be gold, in a fountain, he fell in and was in danger of drowning.

In 1758 he entered the School of Rhetoric, where he remained for three years. While there he showed a most unusual aptitude for writing poetry. When still a youth he wrote a poem of eight hundred verses on the Seasons, in Latin, which has recently been translated and published by one of his descendants, Zanino

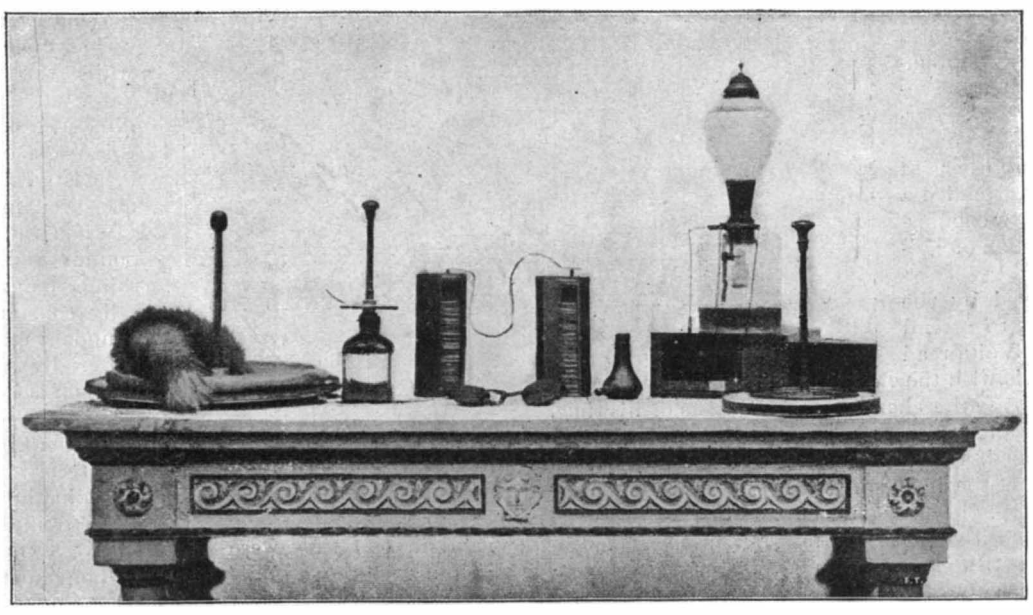


TOMB OF ALESSANDRO VOLTA IN THE CEMETERY AT CAMNAGO.

Volta. His study of philosophy began in the College of the Jesuits, where he, however, remained only one year, and was continued in the Bensi Seminary. He devoted much time to physical and natural sciences and wrote more poetry. About this time he wrote an ode, in French, on the ascent of Mont Blanc, and sent it to De Saussure. When eighteen he corresponded on scientific subjects with the Abbé Nollet, who encouraged him to publish a paper on the causes of electrical phenomena, in which he referred to the unity of physical forces, foreseen by him as well as Spallanzani and other physicists and naturalists of that time. At twenty-four he published and dedicated to Beccaria, the great Piedmont physicist, a Latin memoir, which was followed by another in 1771 on an electrical apparatus of his invention, and this was dedicated to Spallanzani.

In 1774 he was made regent of the schools of Como; an interesting account of this period has been published by Zanino Volta. The following year he invented the electrophorus, which caused a great stir in the electrical world, in other countries as well as Italy, and brought him many honors from numerous academies, leading to his appointment as professor of experimental physics in the gymnasium of Como. One of his innovations in former customs worthy of mention in connection with his work as a professor is the writing of theses in Italian instead of Latin; this he caused to be done because he thought that physical truths which were to be demonstrated by experiments, during which it was necessary to refer to apparatus and the manipulation of the same, could be more clearly set forth in the language of the students.

Investigations pursued by Volta at the hot springs of Pietra Mala and di Velleia led to his discovery of the



VOLTA'S APPARATUS AT THE INSTITUTO LOMBARDO DI SCIENZE, IN MILAN.

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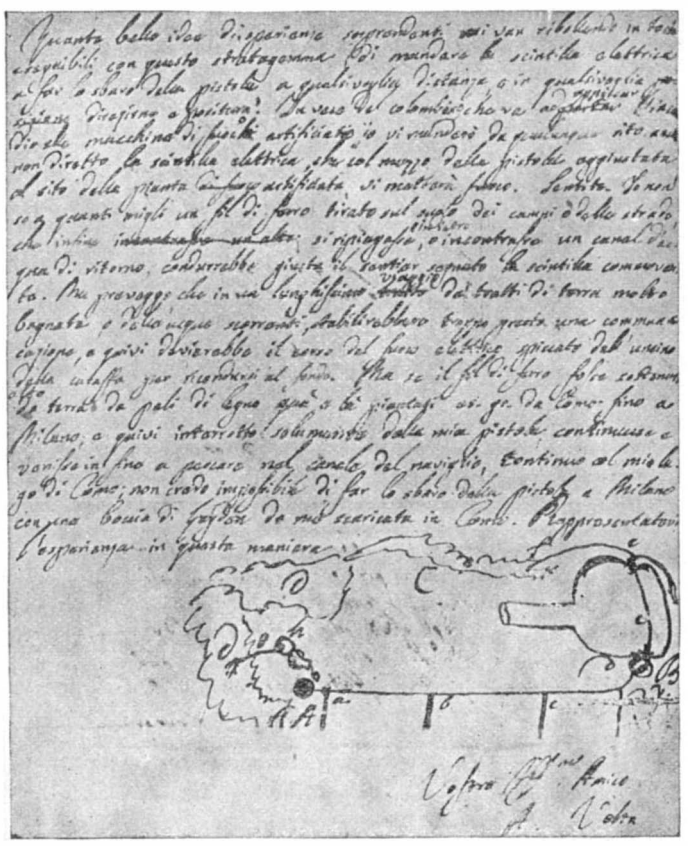
organic origin of marsh gas; and other studies to the invention of the inflammable air pistol, generally known as the "Volta pistol," and the "perpetual lamp," with which he connected his electrophorus as a means of igniting the lamp. He believed that this lamp would lead to the use of hydrogen for illuminating purposes. In 1777 he invented the eudiometer, for testing the amount of oxygen in the air. That same year he went to Switzerland, where he was received with great honor by the Academy of Physical Science in Zurich. The following year, during which he published his memoir "On the Capacity of Conductors," he was called to the chair of physics in the University of Pavia, and soon after he invented the electroscopic condenser. In 1782, after having visited the cities of the Rhine, Brussels, and Amsterdam, he went to Paris to obtain apparatus, and remained there several months, studying, visiting schools, and forming friendships with the greatest scientists of his time, among whom were Franklin, Buffon, Lavoisier, and Leroy. From Paris he went to London, where he read his memoir on the condenser before the Royal Academy, which presented to him the Copley gold medal; and then he went to Germany, where he was received by the Emperor Joseph II., who also awarded to him a gold medal. On his return he wrote his letters to Lichtenberg on "Electrical Meteorology" and the papers on "The Formation of Hail" and "The Expansion of Air."

The discovery of Galvani and the publication of his "De viribus electricitatis" brought Volta back to his electrical studies, with the well known result; that is, the invention of the electric battery. Galvani, the great anatomist and physicist, having already studied the effect of artificial electricity on animal organisms, and desiring to see whether similar results could be obtained from atmospheric electricity, suspended the thigh of a frog from an iron railing by means of a copper hook; a strong wind forced the hook against the railing, and the muscles contracted violently, and by further experiment Galvani found that whenever the nerves and muscles were connected by metal the contractions were produced, but were more violent when two metals were used instead of one. He tried to explain this phenomenon by assuming that the nerves and muscles of the animal formed a kind of Leyden jar which was discharged whenever an external circuit brought them into electrical contact. At first Volta accepted this explanation, but after having made many experiments of his own, he was convinced that the results must be accounted for in some other way. The letters and essays in which Volta describes the observations and reasoning which gradually led to the construction of the electric battery are extremely interesting. He soon came to look upon the muscles of the frog as simply a delicate electroscope which indicated the electric current developed by two unlike metals, for he attributed the electrical effects, which Galvani thought to be due to animal electricity, to the contact of dissimilar substances. This was the origin of the celebrated "contact theory." Galvani never accepted Volta's theories. The former devoted the rest of his life to the study of animal electricity, in which department he did most excellent work that was not appreciated in his time, and died before the voltaic battery or "pile" was given to the world. Volta's original apparatus consisted of a pile of alternate silver and zinc disks, with disks of cloth or paper between them moistened with brine or acid water. Copper disks were afterward used in place of the silver disks. The terminal disks were arranged with ears for convenient attachment of the wires.

September 1, 1801, Volta started for Paris with Brugnatelli, also a professor in the University of Pavia, whose experiments gave to Italy the priority in the application of the electric current to gilding. In Geneva a grand fête was given in honor of the two illustrious scientists. September 28 they arrived in Paris, where their reception was indescribable. Cuvier, Fourcroy, Berthollet, Biot, Hauy, Vauquelin, Pfaff, Lalande, Laplace, Coulomb, vied with one another in showing them honor. October 3, they attended a meeting of the National Institute, and a commission was appointed to discuss the question of galvanism.

On November 6, Volta was received by the First Consul, Napoleon, who desired to attend the meeting of the Institute in which Volta read his paper and repeated the experiments with the electric battery. Bonaparte was amazed to see the chemical decompositions effected by means of the electric battery, and it is said that he exclaimed, turning to his physician, Corvisart, "Doctor, this is the image of life; the vertebral column is the battery, the liver is the negative pole, and the kidneys the positive pole."

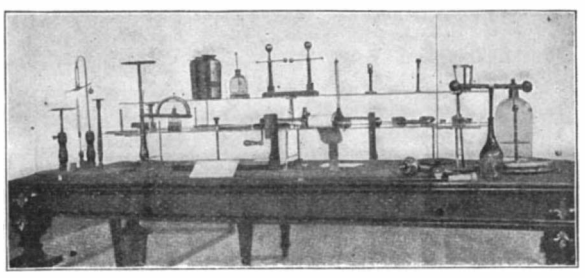
He then spoke as a member of the Institute, declaring that the Institute owed an immense debt of gratitude to foreign scientists who, like Volta, cast such a bright light on science by means of their discoveries, and proposed that he should receive a gold medal. This was sanctioned by the vote of the commission which had been appointed to investigate galvanism, and Volta's triumph was complete. The First Consul presented him with 6,000 lire ($1,140) and an annual allowance, and made him a knight of the Legion of Honor and of the Iron Cross, a senator and a count. Bonaparte always desired to be present at any meetings in the Institute in which Volta participated, and,



AUTOGRAPH LETTER WRITTEN BY VOLTA, RELATING TO ELECTRIC WAVES.

in fact, showed Volta such deference that some of the French scientists were jealous. Napoleon never forgot him. When visiting the library of the Institute one day, in 1803, Napoleon saw a wreath of laurel, on the bronze scroll of which was inscribed "Au Grand Voltaire," and, it is said, he erased the last three letters so that it read "Au Grand Volta." When he visited the University at Pavia, his first question was, "Where is Volta?"

Volta passed the last years of his life at Como, and in his villa at Camnago. His mind remained perfectly clear so that he was able to converse about his favorite



SOME OF VOLTA'S APPARATUS, BATTERIES, ETC., EXHIBITED AT COMO.

ONE OF THE TABLES ON WHICH VOLTA TRIED HIS EXPERIMENTS.

science and to keep up a constant correspondence with the scientists of his time.

July 28, 1823, he had an apoplectic stroke from which he recovered only partially, and died March 5, 1827, of a slow fever, having attained the great age of eighty-two. His remains were carried to Camnago to be interred in the old cemetery, and in 1851 they were placed in a tomb erected by the family in the form of a little temple decorated by statues and allegorical bass-reliefs and a marble bust by Comolli. On August 15, 1838, Como unveiled a statue of him, the work of Marchesi, that stands in the square which has since been given his name. In the aula at Pavia, where Volta taught so many years, the configliacchi placed, at their own expense, a bust by Comolli, and in 1878, the centenary of the appointment of Volta to the chair of physics at the University of Pavia, a statue of him, executed by Tantardini, was placed in the court of the university by Francesco Rocca.

In 1875 Volta's descendants acceded to the desire expressed by the two anthropologists Cesare Lombroso and Paolo Mantegazza and the request of the University of Pavia, and allowed the disinterment of his remains. The ceremony was attended by representatives of the government and of all the Italian universities. The craniometrical examination gave the following results: Cranial capacity, 113·815 cubic inches; anterior-posterior diameter, 7·5 inches; greatest transverse diameter, 6 inches; circumference, 21·8 inches; facial angle, 73°. Cesare Lombroso calculated the weight of the brain to be 72 ounces avoirdupois weight, 15·5 ounces more than the average weight. In size, the skull resembles those of the ancient Romans. He found no depressions nor bumps except in the location that phrenologists usually assign to acquisitiveness. When this portion of Lombroso's paper was read before the Instituto Lombardo de Scienze e Lettere, there was a general laugh, for scrupulous rectitude was one of Volta's best known characteristics.

We hear very little of Volta's private life, but it is said that he was a most devoted son, husband, and father, and had many loyal friends. In 1794 he married Teresa Pellegrini, of a noble family of Como, and they had three sons, Giovanni, Flamino—who died when eighteen at Milan, where his family were living to enable Volta to attend to his duties as senator—and Luigi.

The chief relics of Volta were preserved until the time of the fatal exhibition in a hall of the R. Instituto Lombardo, where there were sixteen large portfolios of his works, published and unpublished, the decorations and medals presented to him at London and Paris, a cast of his skull, and three hundred instruments and objects used by him in his experiments, including the batteries used by him in his demonstrations before the Institute at Paris, the hydrogen lamp which was ignited by the electrophorus, the first eudiometer, the condenser by means of which he demonstrated the electricity of metals, the dry battery which he constructed before Zamboni and De Luc, and other things that are too often attributed to the inventive genius of others. Still other relics are in the possession of the University of Pavia, Il Museo Civico di Como, and of the descendants of Volta.

Internal Resistance of an Eight-wheel Passenger Locomotive.

An important article by Prof. Goss on the internal resistance of an eight-wheel passenger locomotive as determined by experiments on the Purdue testing plant, appeared in the latest issue of The Railroad Gazette. From the results of locomotive road tests and tests of stationary engines, the internal resistance of locomotives has been variously estimated at different times, but because of the very meager data upon which these estimates were based, the question has always been surrounded with a good deal of uncertainty. Prof. Goss finds a marked variation in the percentage due to changes in cut-off and speed. The highest observed value of the engine friction in percentage of the indicated horse power was 23·3 per cent, corresponding to fifty-five miles an hour and 6 inches, or one-fourth, cut-off; while the lowest value obtained was 5·5 per cent at twenty-five miles an hour when cutting off at 10 inches of stroke. The wide variations when percentages are considered are rather misleading, and are due to the horse power absorbed by friction, varying directly with the speed, while the indicated horse power does not so vary, but shows, when plotted with speed as ordinates, a curve concave downward. Because of this, says our contemporary, probably a clearer idea is got by considering the friction losses as measured in drawbar pull.

When thus taken, it appears that between 75 pounds and 130 pounds boiler pressure, other things being equal, the friction loss is practically constant; and that the friction loss in pounds pull at the drawbar does not change materially with changes in speed, but decreases as the cut-off is lengthened.

ONE of the most violent hailstorms of which we have any record burst over Madrid on June 9 toward six o'clock in the evening, lasting for twenty minutes. Trees were stripped of their foliage, window-panes were broken by thousands, and outhouses were demolished. The hailstones which fell are said to have been as large as nuts. On one of the principal avenues—Paseo de la Castellana—the hail descended in an avalanche, and in melting, formed a perfect river.

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A CATALINA WALKING FISH.

BY PROFESSOR C. F. HOLDER.

Among the many interesting fishes found in the Santa Catalina channel, California, and about the islands of the group of that name, is a member of the Pediculati, a giant of the tribe, differing materially from the small form common in the gulf weed of the Gulf of Mexico and vicinity. This singular creature has been observed but twice here, the specimen shown being found by the writer. The fish was about twelve inches in length and very bulky—a decided contrast to its small allies of the Atlantic. Its skin was rougher than that of a shark, covered with points, and was a rich yellow hue, dotted with spots of brown. The mouth was enormous, opening downward, giving the animal a very ludicrous appearance. Above the mouth was a projection, recalling the fin of the angler, and back of it another and larger, forming quite a lump. The eyes were small and dark, and the gills remarkable.

The peculiar character of the gills gives to this group its chief individuality. The gill openings are represented by a simple foramen, one on either side of the fish back of the base of the pectoral fin. In the ordinary fish the actinost bones are four in number, but here they are but two or three and very elongate, forming a pedicle to the pectoral fins, this giving the name Pediculati to the order. The fish is extremely sluggish, and has the faculty of moving along the bottom by a decided foot-like movement of its pectoral or side fins; hence the common name walking fish, though its walking powers are not so remarkable as might be supposed from the name.

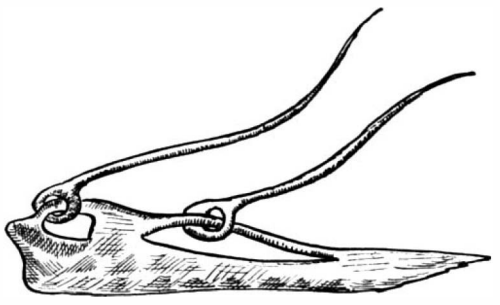
The so-called legs or pectoral fins are well shown in the accompanying photograph and attract attention at once from even the layman. They seem to be thrown forward with a pronounced elbow, and to a limited extent these so-called legs can be used; the fish resting upon them, a position which raises its head and brings the oblique mouth in position to engulf any prey that may approach. The bunch of weed in front of the fish illustrates the size and appearance of the nest it builds for the protection of its eggs. In the Atlantic forms the nest is constructed of sargassum and floats at the surface, supported by the balloons or floats of the weed; but in this fish the nest is formed of weed at the bottom. The fish collects bits of weed and tendrils of kelp, which it winds roughly together and connects by a thread that resembles slime, but which has tenacity enough to hold the ball together. This cord is taken from a special pore in the ventral surface of the fish.

The fishes of this entire group are famous mimics. Many simulate the bottom and its rocks so perfectly that it is difficult to see them. All have a peculiar development of the dorsals. In the specimen shown the first dorsal is a curious short prominence, to some extent movable, with a pseudo barbel or bait upon its tip. Back of this is a larger and more prominent organ, which in default of better reason are called lures, and are supposed in some way to attract prey within reach of the oblique mouth. The writer has kept the walking fish of the Gulf of Mexico in confinement, but has never noticed any disposition to capture prey in this way. It is a sluggish fish, lying perfectly quiet for hours like the ordinary sculpin.

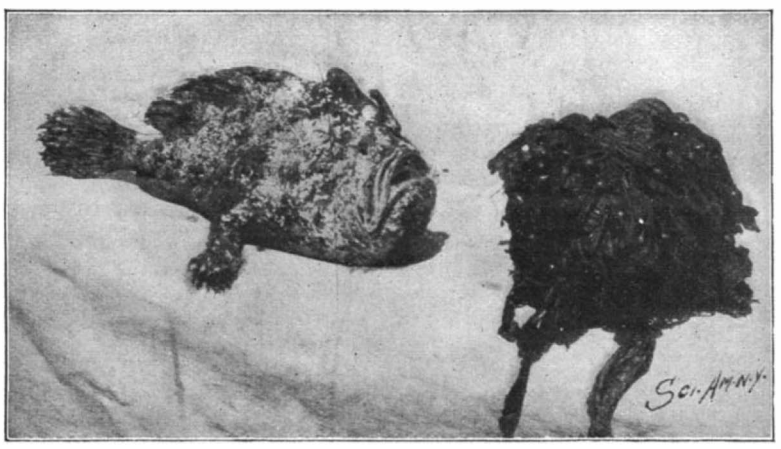
The most remarkable development of these fins is found in another family of the Pediculate fishes, the anglers or Lophidæ. The writer has also kept this fish in confinement and observed it carefully for days and weeks, hoping to prove or disprove the fishing story, which seems, like others of its kind, to be firmly intrenched in the public mind. A number of writers who are authorities make the statement that the fish does angle for its prey. T. S. Cobbold, lecturer on zoölogy in the Middlesex College, England, says that the fish "is provided with a pendulous flattened membrane, resembling a small flag; this can be hoisted at the animal's will, and while it calls the attention of little fishes in the neighborhood, at the same time serves as a bait, or, more strictly, a decoy. When about to take a meal, the body of the fishing-frog is carefully concealed by mud stirred up in the way already mentioned; and the bait being now elevated above the muddy zone, and shaken to and fro with a winning or 'killing' effect, the prey immediately gathers round; while no sooner have a sufficiently numerous group assembled—all being merrily engaged in tugging away at the decoy—than they are remorselessly and by one fell swoop consigned by the sea-devil into its capacious stomach. Surely this is a cogent illustration of final intention."

On the other hand, many authorities deny this, and no one professes to have seen the fish in the act of casting its deadly fly and bagging its game. In the specimen observed by the writer the fish presented a most remarkable appearance. To the layman it was invisible, even when lying amid rocks not three feet away. It weighed, perhaps, fifteen pounds, yet flattened out, so mimicking a rock that only the most scrutinizing eyes could distinguish it. Not only did it mimic the rocks in color, but its shape and the peculiar barbels of flesh carried out the resemblance. From the lower jaw depended a mass of barbels which resembled seaweed; and the color tints of the body were perfect in their imitation of the surroundings. The foremost dorsal spines were very long, the first being at its tip—a leaflike filament of the prevailing color of the fish, the entire organ resembling a stalked weed (Laminaria).

How perfectly this ray or two of them could be used as a fishing rod can only be appreciated by a glance at the bone which the writer removed. The first ray is articulated at its base, like the links of a chain having a separate orifice; the second has a still larger moving space, and as can be seen, the ray can be moved backward until it lies almost flat upon the back of the fish; or it can be raised erect, or again bent forward so that the bait or supposed lure hangs directly in front of the mouth. In this position there is no doubt that it would, if waved gently, accidentally or purposely, attract the attention of small fishes, which, hovering over the mouth of the angler, would naturally be ingulfed in the cavernous opening. The angler has a rapacious appetite; it swallows large fishes, and has been known to devour sea birds.



ANATOMY OF DORSAL RAYS, OR "FISHING RODS," OF LOPHIUSO, SHOWING THEM THROWN BACKWARD.



WALKING FISH AND NEST.

One of the most interesting of the Pediculati is the batfish, so called from its supposed resemblance to a bat. It has the same peculiar pectoral fins which have been seen in the others mentioned, and which give the name of walking fishes to the group. Its body is covered with diminutive spines or barbels, which aid in its remarkable mimicry; and directly over the mouth projects a pointed, hornlike object, and in a pit below it is a singular appendage, supposed to be a lure, in reality the first dorsal. In specimens observed by the writer this appendage was of no special use; yet its curious appearance suggested that it had some office in the economy of nature.

The Malthe would be at once recognized as a walking fish, its "elbows" being very pronounced, the fin being at the end of a peculiar projection that has a superficial resemblance to a thigh. On the bottom the fish raises itself slightly, resting in front on the ventral fins, which represent the front legs, and behind in the anal, and the two enormous pectorals, which are apparently the hind legs; all in all, being one of the most bizarre forms of the sea. The fish is more sluggish than any of its allies previously described, lying on the bottom, not seeking its prey, but waiting for it to pass, then rushing at it violently after the manner of the sculpins.

New Cotton Mill in Mexico.

Consul Canada, of Vera Cruz, under date of May 18, 1899, transmits newspaper clippings describing a new cotton mill located in Orizaba, about 82 miles west from Vera Cruz, on the Mexican Railway, as follows:

The company interested in the new concern consists mainly of French capitalists. The capital is $2,200.000.

Work on the building was commenced December 1, 1896. In the latter part of August, 1898, the first turbine wheel was installed.

The power is derived from a fall in the Rio Blanco—a height of 82 feet—5,000 liters per second. The water is stored up in a tank containing 1,200 cubic meters, moving two turbine wheels of 500 horse power each. From the turbine pit, 135 feet deep, the water flows through a tunnel 670 meters in length and is used again by the cotton factory at Nogales, another suburb of Orizaba.

The factory occupies an area of 170 square meters. The buildings are lit with 1,200 incandescent lamps and 20 arc lights. The company generates its own electricity.

In addition to the power derived from the turbine wheels, there is a magnificent steam engine of English make; capacity, 450 horse power. There are 8 Northrop American looms. The balance of the machinery, with the exception of the electrical plant, is English. The electrical part is French.

This factory is now the second largest in the republic, the largest being that at Nogales. This concern employs some 950 operatives—men, women, and children—but the help, so far, is almost entirely male, girls and women being scarce in the district.

Germans and Frenchmen are in charge of the printing. Six colors are printed simultaneously, with fine engrossed English cylinders. The capacity of the mill is 1,500 bolts a day.

The mills are turning out various grades of goods, from common manta to prints. At present they are not making a very high class of goods, but when the help gets more intelligent they will do so.

The Waste Paper Nuisance.

Owing to the great cheapness of paper, caused by the ever-increasing use of wood pulp in its manufacture, and owing to the fact that it is practically valueless after having served its original purpose, it is the cause of a nuisance very prevalent in large cities. The paper is thrown into the streets or in lots, and is blown about with every gust of wind and collects under stoops and in fence corners, where it is sometimes set afire by mischievous and thoughtless urchins. It is readily conceded that waste paper is dirty and untidy, and, according to The New York Medical Journal, may, under some circumstances, act as a disseminator of disease. No effectual remedy for this has been devised, but that journal proposes to have ornamental iron urns swinging on trunnions, in which papers could be put and burned on the open-bottom grate. The object of having them swinging is to empty out stones and other incombustible matter. They might be put up in proper places and at convenient distances apart. As children like to play by making fires, it is likely that they will hunt for materials to gratify their inclinations in this respect.

The true solution of the waste paper problem is to pass stringent city ordinances, and see that they are enforced. In some cities it is an infraction of the sanitary code to throw papers in the street, and it is to be hoped that the regulations which exist will be enforced.

ONE of our correspondents, Mr. W. H. Smith, of Seward, Neb., sends us an interesting account of a remarkable stroke of lightning which killed five young men at one time. They were riding in a wagon with a team of horses, and they must all have been instantly killed, together with the horses. They were found the next morning by a farmer passing along the road.

The Current Supplement.

The current SUPPLEMENT, No. 1229, has a number of articles of great interest. The front page is taken up by a large engraving of the new statue of Benjamin Franklin, which has just been erected in front of the post office of Philadelphia. "Glue Testing" is an important technical article. "Magnetism Illustrated by Air Currents" describes interesting experiments. "The Operating Cost of Horse and Electric Delivery Wagons in New York City" is a very timely article. "Mapping the Mammoth Cave," by Dr. Horace C. Hovey, describes in an interesting manner the methods employed in determining the size and shape of the passages in the Mammoth Cave.

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RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

WEED-SEED DESTROYER.—Adam Ree, Georgetown, Minn. The inventor has sought to produce a plow capable of making either a shallow or deep furrow, according to the adjustment of certain parts. The plow is provided with a draft-frame on which a plow-beam is mounted to be raised and lowered, whereby the parts are maintained in that rigidity necessary to withstand the strain to which they are subjected when making a deep furrow.

Engineering-Improvements.

ROTARY ENGINE.—Alvin H. Shoemaker, Fort Hamilton, New York Harbor. The present novel construction of rotary engine embodies an outer wheel, an inner wheel eccentric to the outer wheel and having cylinders whose pistons are connected with cross-heads moving radially in ways formed in the outer wheel. The outer wheel is suspended from the inner wheel by means of crank-hangers, and is preserved in its eccentric arrangement to the inner wheel by especial mechanism.

ROTARY ENGINE.—Gabriel P. B. Hoyt, Jamaica, Queens, New York city. This invention is chiefly concerned with the provision of a packing. Two packing-plates, secured to each other, are fitted to slide in the piston-head. Two additional packing-plates are located between the two first-named packing-members and engaged therewith so as to be spread longitudinally with the axis of the piston, as the first named packing-plates move transversely to the axis. Slides are mounted in the head, having inclined surfaces engaging the first-named packing plates to push them outward transversely to the axis of the piston.

REVERSING SLIDE-VALVE.—Henry Damerell, Ludlow, Mo. Connected with a steam-cylinder having a central exhaust and two end ports is a compound reversing-valve consisting of a flat slide-section moving on the ports of the steam-cylinder and having five passages. A sleeve connected with the slide-section emerges from the steam-chest through a stuffing-box. A distributing-valve section moves upon the slide-section and has a central exhaust-chamber, end exhaust-openings, intermediate induction-openings, and an attached rod extending through the sleeve of the other valve-section and having an independent external adjusting connection.

STEAM-ENGINE.—Gabriel J. L. Henry, Quebec, Canada. The engine belongs to that class in which motion is obtained by the alternate expansion and contraction of an extensible casing. The casing consists of a series of elastic annular sections, to the uppermost of which a top is secured extending inwardly so as partly to fill the central space between the sections. Devices are provided for controlling the admission and exhaust of the steam, and are located in the lower part of the casing and are also projected inwardly to fill the central space in conjunction with the top when the casing is contracted.

Mechanical Devices.

MONEY HOLDER AND CHANGER.—George T. Farnell, Bayborough, N. C. This apparatus for holding money and making change delivers coins by the operation of suitable key-mechanism. The coin-delivering mechanism for each denomination of coin is adapted for the delivery of one, two, or three such coins as may be desired. The apparatus embodies a number of overlying slides, each, after the first, having lateral shoulders. There are also key-levers, each except the last being provided with notches through which the shoulders in the preceding slides may play in the normal position of the key-levers.

SHUTTLE FOR SEWING-MACHINES.—Percy H. Hewitt, Edwin A. Cockle, and Charles Matthews, London, England. The shuttle is to be used on two-thread sewing-machines having rotary, reciprocating, or oscillating shuttles. The shuttle is adapted to receive an ordinary full-sized reel of thread, so as to avoid the disadvantages arising from the use of a special reel of small capacity, these disadvantages being the loss of time in winding the thread from the reel onto the spool and in exchanging the empty for a full reel. Moreover, a reel-winding mechanism is rendered unnecessary.

DOUGH-MIXER.—Wladyslaw and Peter Kryszewski, Jersey City, N. J. The dough-mixer comprises a bucket having a removable cover from which a central shaft depends, carrying a blade at its lower end. At each side of the central shaft, depending shafts are located, also carrying blades. These shafts are turned by a hand-operated horizontal shaft through the medium of bevel-gears.

SHOE-STAPLING MACHINE.—Nathan S. Wakefield, Pomona, Cal. It is the purpose of this invention to provide a machine for sewing the soles of boots and shoes to the uppers of the turns or welts, by means of wire to prevent the shoe from ripping and to render it more flexible than when sewed with thread. The machine is provided with a pair of segmental oscillating plungers to form a piece of wire into a curved staple and to abut against the welt while the staple is driven through the welt, and the upper and channel-flap of the sole. An oscillating pusher or driver operates between the plungers and engages the middle of the staple to drive the side bars of the staple through the welt, and the upper and channel-flap.

MACHINE FOR LABELING TINS, JARS, BOTTLES, ETC.—James R. Bradley, North Unley, South Australia. In this machine are included a device for feeding the tins, jars, and bottles to be labeled, a labeling case and label elevating and retaining mechanisms, a pasting device, and an apparatus for receiving the tins, jars, and bottles from the feeding device and forwarding them over the label-case. All the devices are actuated from a main shaft, and each device is arranged and designed to perform its work at the proper time relatively to the operation of the others.

Miscellaneous Inventions.

ADJUSTABLE STOCK FOR FIREARMS.—Oliver O. Scripture, Prescott, Arizona Territory. The butt of the gun has a concavity at its forward end fitting into the convex rear end of the barrel section. A transverse pivot is located in the barrel-section. A connecting rod extends rearwardly through the butt, and has a flattened front end mounted directly on the pivot. The rod can be longitudinally moved to clamp the sections together.

LIQUID-LEVEL INDICATOR.—Heinrich Rasmussen, Lund, Sweden. The present invention provides a device for holding or supporting gages. The gage is held in top and bottom supports formed with seats and holding a glass tube. A rod is secured to one of the supports, extends through the glass tube and tubular support, and has its end threaded to receive a nut which may be turned to bring the two supports more closely together.

COVER.—Frank B. Read, Manhattan, New York city. This cover is made of a single piece of fabric, creased to form a bottom, continuous sides, overlapping flaps for the ends, and a double-up reinforce-flap for each end, extending from the bottom to engage the lower portion of the overlapping end flaps and part of the bottom and sides. The cover is designed to be used on caskets, pieces of furniture and the like.

FOLDING CRIB OR CRADLE.—Samuel E. and Helen Oakes, Passaic, N. J. The end frames of the crib each consist of crossed or pivoted legs which may be locked in fixed position. Rods connect the upper ends of the legs of both end frames. A folding mattress-support is suspended from the rods and consists of cross-bars pivoted to each other to form lazy-tongs. The ends of the cross-bars are connected with the longitudinal bars of the frame.

MAGAZINE-CAMERA.—Andrea Angel, Liverpool, England. This invention relates to improvements in magazine-cameras for storing and exposing a series of sensitized films separated by backing-cards alternated with the films in the usual manner. The invention provides a mechanism which prevents the buckling of the films, holds them perfectly flat during exposure, releases them in succession, and disposes of them and their backing-cards after exposure. The especial object of the invention is to dispense with the notching of the films or otherwise adapting them for the action of the releasing mechanism.

DOOR-HANGER.—Charles A. Ensign, Manhattan, New York city. The object of the present invention is to provide a device for hanging sliding-doors. Two supporting-trolleys traveling on a novel track are provided for each door, both trolleys having members adapted to be drawn together or apart for the purpose of raising or lowering the door by means of screws located at the forward edge of the door.

PROCESS OF ORNAMENTING METALS.—Parker C. McIlhiney, Manhattan, New York city. The process consists in producing an uneven surface upon a metallic backing, electroplating the surface, and removing or cutting down portions of the plating to expose the underlying material. The ornamentation thus produced resembles inlaid work.

DESK.—Eliza M. Mosher, Ann Arbor, Mich. This school-desk is provided with an adjustable rest which in one position serves as a front flange and in another position as a support for a book, drafting or writing copy. Such articles are held above the top of the desk at an inclination to enable a pupil to assume and retain a natural position. The adjustable rest when in position at the front of the desk serves not only as a flange, but also as a support for the back of a book placed in position for study.

FEED-WATER HEATER.—Henry A. Millar, Buenos Aires, Argentina. This inventor has provided a novel arrangement of tubular receptacles, pipes, and tubes in boilers, whereby the feed-water forms a deflecting arch to deflect the heat arising from the burning fuel to the front of the fire box, at the same time highly heating the feed-water and causing a circulation of the water in the boiler through the feed-water device.

RECORD-HOLDER.—John C. Kattell, Passaic, N. J. The holder for protecting phonographic records during transportation comprises a casing having a cover and a mandrel secured to the bottom of the casing. The mandrel has a length greater than that of the casing and passes through an opening in a top for the cover.

DRAWER-CENTERING DEVICE.—John M. Hoffmire, Red Bank, N. J. The purpose of the present invention is to provide a simple means for centering drawers when closed. The invention provides a case open at its opposite ends and having slideway-channels in its opposite walls. Each drawer has flanges to engage in the channels, one of the flanges being provided with a recess between its ends, engaged by a rounded stop-dog. A spring is at ached to the case, and upon this spring the dog is mounted.

DEVICE FOR REMOVING SPLINTERS FROM GROUND WOOD OR SULFITE.—Joseph Goodfellow, Fort Edward, N. Y. This device is a pulp-strainer adapted to remove slivers and the like from ground wood-pulp or sulfite used in making paper. Within a tank having a discharge-orifice a reticulated cylinder projecting above the tank is mounted to turn, having communication with the discharge-orifice at one end of the cylinder. A closure is mounted above the tank for each end of the cylinder. An inclined table leads to the upper side of the cylinder, and a feed-box delivers the pulp to the table. As the straining-cylinder is rotated the desirable portions of the pulp readily pass through the meshes to the interior of the cylinder; while the slivers and foreign matter are discharged from the proper orifice.

MOLD FOR CEMENT OR CONCRETE.—Oliver P. Barnett, Allerton, Iowa. In the construction of small cement or concrete culverts, drains, and the like, the chief difficulty has been to provide efficient means for supporting the core around which the material is molded and for removing the core after the cement or concrete has set. The inventor has provided improved apparatus comprising a collapsible core, and separable parts forming the exterior or body of the mold, which are in practice suitably connected and adapted to be removed after the core.

HOSE-GATE.—Edward S. Clarke, Richmond, Va. To provide a simple means for clamping a hose to prevent the passage of water is the object of this invention. The hose-gate used for this purpose comprises a frame composed of sections jointed at one end and having at the other end clamping-jaws. A screw is connected with one of the sections and has a threaded bearing in the other section. A gear is movable along the screw, and meshes with a pinion operated by a handle.

PHOTOGRAPHIC PRINTING-FRAME.—William McDade, Newerf, Pa. Ordinarily in making large blue prints from tracings and stenciled sheets, it is difficult to remove the wrinkles from the sensitive paper or transparent tracing, and the result is that as the sensitive paper does not at all points lie closely to the tracing, imperfect reproduction of the lines occurs. The present invention uses an inflatable pneumatic pad for the purpose of pressing the tracing and paper closely together.

SKIRT-BINDING.—Cyrus L. Sulzberger, Manhattan, New York city. The skirt-binding has its body and brush so doubled and stitched that a secure union of the body of the binding and the brush is effected, at the same time giving the desired stiffening, flexibility, and strength to prevent a wearing-out of the binding at its lower edge.

CORSET.—Frank Tucek, Manhattan, New York city. The body of the corset terminates along the front and side at the waist-line and extends downwardly at the rear beyond the waist-line. A hip-piece is secured to that portion of the body which terminates at the waist line. The rear end of the hip-piece is extended beyond the front edge of the extension of the body and is separate from the extension. A proper fitting is thus obtained, and the upper body portion of each half of the corset of a single piece of fabric, thus avoiding a multiplicity of seams.

CANDLE-EXTINGUISHER.—Gustavo Bacci and Leopold B. Pispoco, Manhattan, New York city. The ordinary extinguisher employed for putting out the flame of altar candles presses the wick down, thus often displacing the candle before its flame is quenched. The inventors of this device extinguish candles by directing against the flame the products of combustion arising from a lamp provided with a deflecting chimney. The carbon dioxid gas, it is said, will immediately extinguish the flame without blowing it out.

SUSPENSORY BANDAGE.—John J. Cooper, Manhattan, New York city. This combined jock-strap and suspensory is constructed so that it is readily secured in place and that the waist-band is not disturbed in opening and closing the suspensory.

APPARATUS FOR TREATING TOBACCO.—Charles E. Couty, Louisville, Ky. The apparatus is designed to restore funked or moldy tobacco to its original quality. The tobacco is hung in racks in a compartment capable of ventilation, and is subjected to the action of steam supplied in a peculiar manner. It is stated that defective tobacco of a high grade, which is usually sold as a low grade tobacco, may be restored to its normal condition without injury to the leaf.

MOLD AND WEIGHT-GAGE.—Arthur C. Gillette, Jersey City, N. J. This device is especially adapted to form a number of blocks from a mass of soap, butter, or the like. The mold has a body-frame in which a follower is adapted to travel. Cutters are attached to the body-frame below the follower. Downward pressure is exerted on the follower and upward pressure on the body-frame to cut the butter or soap into blocks, uniform in size and weight. The board upon which the pats or blocks are formed is made in separable sections to enable the pats to be readily removed.

ARTIFICIAL TOOTH.—Henry J. Miller, Paris, France. The tooth comprises a body having a metal-lined cavity, the lining and body being provided at the sides of the tooth with notches leading into the cavity. The metal at the time of pouring runs from one tooth to another in these notches. In this manner the teeth are made solid one with the other.

MINERAL-LODE TRACER.—Alfred R. Heyland and John H. Gray, Kaslo, Canada. The tracer consists of a graduated arc-plate mounted on a standard, two circular plates turning on each other and secured upon a projection from the central portion of the straight edge of the arc. An arm is secured to the upper plate and carries sights and a leveling instrument. The arc-plate is set perpendicularly to the lode and swung to correspond with the dip of the lode. The arm on the upper circular plate can now be turned so as to move in the same plane as the vein or lode, enabling the lode to be located at points where it is not visible.

DRILL.—Peter C. Forrester, Spring Valley, Ill. The drill is designed to be used in drilling rails and is constructed so that the weight of the operator in sitting serves to keep the tool point up to its work. On a support a drill-frame is mounted to move, and to the drill-frame a lever is pivoted at one end and adapted to sustain the operator so that his weight keeps the drill to its work. The drill and its support may be compactly folded and readily carried upon a hand-car.

Note.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

NEW BOOKS ETC.

Les Fourmis de M. Charles Janet. Par M. E. Van Overloop. Bruxelles. 1897

Sur les Nerfs de l'Antenne et les Organes chordotonaux chez les Fourmis. Par Charles Janet. Extrait des Comptes rendus hebdom. des séances de l'Académie des Sciences. Paris. 1894.

Die Pflanze im Zauberglauben. Ein Katechismus der Zauberbotanik. Mit einem Anhange über Pflanzensymbolik. Von G. W. Gessmann. Vienna: A. Hartleben. 1899. Pp. 252. Octavo. With 12 illustrations. Price paper, $1.50.

In olden times it was the custom to attribute to various things a certain influence over good and evil spirits. Plants seemed especially adapted for this purpose; for from time immemorial they had been regarded in the poetic lore of all nations as the toys of gnomes and elves. Certain herbs were said to be looked upon with particular favor by these little beings; while others, by reason of their poisonous nature, were shunned. The wonderful development of the plant from an insignificant seed to a luxuriant, beautiful flower, could be ascribed only to the existence of a "plant-soul." Hence, plants in the eyes of the simple country folk were the expression of a mighty spiritual force, the force of nature. The curious volume now lying on our table describes the part played by each plant in the superstition and magic of olden times.

Die Fabrikation der Emaille und das Emailliren. Anleitung zur Darstellung aller Arten Emaille für technische und künstlerische Zwecke und zur Vornahme des Emaillirens auf praktischem Wege. Von Paul Randau. Vienna: A. Hartleben. 1899. Pp. viii, 215. Octavo. With sixteen illustrations. Price, paper, $1.

The present third and revised edition of Herr Randau's work offers to the manufacturer of enamels and to the metal-worker a handbook on the art of enameling. The industrial side of the subject has received the most attention; but since enameling is now employed in the decoration of art objects, the author deemed it advisable thoroughly to describe the making of colored enamels. The author states that the many formulæ which he gives for enameling have all been carefully tried. For this reason the work possesses a practical value which no doubt will be appreciated by the artisan.

Das Verzinnen, Verzinken, Vernickeln, und das Ueberziehen von Metallen mit anderen Metallen ueberhaupt. Handbuch für Metallarbeiter und Kunstindustrielle. Von Friedrich Hartmann. Vienna: A. Hartleben. 1899. Pp. viii, 222. Octavo. With three illustrations. Price, paper, $1.

Before the appearance of "Das Verzinnen, Verzinken, etc.," there was no book in German technical literature which discussed the difficult task of the metal-worker in covering metals with other metals, or in giving to a metallic surface any desired appearance. Arduous as his work undoubtedly was, the author of this book has, nevertheless, described the various processes employed in coating metals with tin, zinc, and the like, in a style so clear and simple that it can be understood by any German mechanic of ordinary intelligence.

Isthmus of Panama, Nicaragua, Canal Routes, etc. By Thomas Wright Hurst, 1452 West Madison Street, Chicago. With maps. Pp. 98.

This very timely work is a compilation of various articles on the subject written for the technical journals by the author and various other writers. It also contains a valuable collection of reports, letters, memoranda, etc., by various engineers, travelers, etc., who have studied the canal problem on the spot. In addition to Panama and Nicaragua, other routes, such as San Blas and Darien, together with the Tehuantepec ship railway, are reviewed. Such a work is needed at a time when the country is considering the question of relative cost and advantages of the various routes.

The Torpedo in Peace and War. By Fred T. Jane. Elaborately illustrated by the author. London: W. Thacker & Company, 2 Creed Lane, E. C. Calcutta: Thacker, Spink & Company. 1898. Pp. 164. Price $4.

The matter in this work is written in the characteristic and very readable style of the author, whose works on naval subjects are favorably known wherever an interest in naval affairs exists. The author explains what is the true sphere of the torpedo boat and the destroyer, and this is done in the course of a series of sketches of what he calls the social side of torpedo-craft life as seen by him during naval maneuvers and other personal experience of the torpedo service. The illustrations are graphic and on the whole fairly good.

Plaster Casts and How They are Made. By Frank Forrest Frederick. New York: W. T. Comstock. 1899. 16mo. Pp. 131. 61 illustrations. Price $1.50.

So far as we know, there is no book on plaster casting in the English language, and for this reason we would welcome almost any contribution to the subject; but Mr. Frederick's book is most admirable and treats the subject in a thoroughly practical manner. We have had many inquiries for a book on this subject, which shows that there is a legitimate field for it. The illustrations are admirably adapted to give the reader an excellent idea of the method of doing plaster casting of all kinds. The subject is treated with special reference to the use of art students and sculptors.

Better World Philosophy. A Sociological Synthesis. By J. Howard Moore. Chicago: The Ward Waugh Company. 1899. 16mo. Pp. 275. Price $1.

The author is dissatisfied with the egoism of our times. He feels it is short-sighted, mischievous, and unnecessary. He believes the future is to see better things; he pleads for the social recognition and control of laws of selection and evolution through a scientific stirpiculture of humanity. This book will undoubtedly interest many readers.

Meisterwerke der Baukunst und des Kunstgewerkes. By Hubert Joly. Wittenberg, Germany. Price 50 cents.

This is a beautiful periodical, something on the order of Das Museum, but devoted to architecture and art handicrafts. The numbers will appear at intervals of three or four weeks, and the contents will be arranged according to the respective countries. Each will contain 23 large half-tone engravings. The more periodicals of this kind the better, and we only wish that some one will publish a similar periodical in the United States. As there is no text, and the titles are translated in English, we see no reason why Meisterwerke should not have a considerable circulation in the United States.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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Minerals sent for examination should be distinctly marked or labeled.

(7689) J. W. B. asks for the composition of the materials used in making the electro-polishing cloth; it is a cloth filled with something, and is used to polish all kinds of metal, silverware and glass. Also the composition of the magical sponge used for the same purpose. A. Dissolve in 20 ounces of water 4 ounces of soap and gradually add 2 ounces of pumice stone or finely powdered emery. Work this well into coarse cloth with the aid of a sponge. For silverware and glass use jeweler's rouge instead of pumice stone and emery. We are unable to give you any information regarding polishing sponges.

(7690) L. E. T. asks: Why is lightning always visible around the horizon, never being seen directly overhead? A. In answering this question, we should, in the first place, express a doubt of the statement that lightning is never seen directly overhead. It is true that people very rarely look directly overhead; but if they did, we think they would sometimes see the lightning flash across the zenith from one part of a cloud to another part. By far the greater number of lightning flashes are from one cloud to another, and but few from the cloud to the earth. Now to answer the question: It is a fact that most of the lightning flashes are toward the horizon. This is due in general to the fact that the earth around us seems to be a plane and the sky seems to be a dome. A storm cloud moves over the surface of the earth at the same distance above it, disregarding inequalities. When first seen, it is perhaps twenty miles away from the observer in a straight line. It is then seen on the horizon. When the cloud has moved twenty miles, it is directly overhead. It has seemed to rise from the horizon to the zenith, but its actual motion has been along the earth's surface. Its apparent rising is optical, only, and not real. The lightning which plays over the face of the cloud during this time shares the same optical change, and many of the flashes seem to go toward the ground. This appearance of downward motion of the lightning is also an illusion. The passage of a lightning flash is instantaneous, and we in our minds assign a direction to it. It is possible to train one's self to see the flash go up from the earth to the cloud. Prof. Snell, of Amherst, used to say to his students that he always saw the lightning flash up from the earth to the cloud. Another effect of projecting the motion of the cloud, which is nearly horizontal, against the concave dome of the sky is to cause the apparent velocity of the storm to increase very rapidly as it comes near us. The cloud seems to rise very slowly at first and to move much more rapidly as it comes over our heads. A gathering storm may increase its velocity of progression, but a thunderstorm which may travel several hundred miles before it uses up its force, is visible above any one horizon for a small portion of its course. Its actual motion, therefore, is quite uniform. Its acceleration is due to the fact that it is much nearer to the observer when it is nearly, or quite, over his head.

(7691) W. S. L. writes: 1. Have read your description of the Jeanty battery. 1, What voltage will each cell give and what amperage on short circuit? How many cells will be required to charge storage battery? A. We have no knowledge of the Jeanty cell beyond what is contained in the SUPPLEMENT, No. 1225, translated from the French journal Cosmos. It is however a gravity cell, and will give an E. M. F. of a little over one volt. Its amperes will vary with the total area of the zinc and copper plates used and the distance between them. This cell can be used for any purpose for which the gravity cell can be used. In charging storage cells, five of these cells will be required for each two storage cells. We do not know whether these cells have been introduced into the United States or not. 2. How many cells of storage battery and what size for one, two, and three ten candle power lamps? A. Ten candle power lamps are made for a great many different voltages. To light any lamp by a storage battery, take half as many cells as the voltage of the lamp. The size of the cell determines the ampere hours it will give, that is, the length of time it will light the lamps. Without knowing what current the lamps use, we cannot tell the number of cells required.

(7692) F. A. W. writes: I would like to ask a few questions in regard to the primary battery Jeanty that you illustrate in issue of June 24, 1899. What is the E. M. F. of battery? Are they made in different sizes? If so, what is the size and weight of cells of different capacity? I am looking for a primary that I can operate a lamp for a stereopticon outfit. Can this cell be used successfully to charge storage battery? A. See answer to last query. You will require about fifty of these cells to light an arc lamp for a stereopticon. It is of course possible to use a battery for a stereopticon, but it is an expensive mode of getting light, both in labor and materials. Where the current for incandescent lighting cannot be had, there is no better light for a stereopticon than the calcium light. Many prefer it for its softness, even when the electric light can be had.

(7693) C. B. M. writes: In experimenting with electric detonators for blasting, etc., I wish to procure some data regarding same, such as resistance of platinum wire, heat generated, amount of current required, etc. A. The construction of an exploder with which to set gunpowder on fire is not difficult. Take two pieces of rather coarse copper wire, No. 14 or 16 will answer, and join the ends with a piece of rather fine platinum wire, No. 26 or 28 will answer. The platinum and copper wires should be joined by twisting rather than by soldering, and not more than a quarter of an inch of free platinum wire is needed between the copper wires. The other ends of the copper wires are to be joined to the battery. The platinum wire is buried in the powder to be ignited. When the circuit is closed, the electric current heats the platinum wire to redness, and this sets the powder on fire. A couple of cells of dry battery should be sufficient. The resistance of platinum, is nearly 5¾ times that of copper, size for size.

(7694) W. F. D. asks: 1. Is there any known substance (or substances) through which electricity cannot pass? If so, please name them? A. Any insulator fulfills the requirement of this question. There are many of these. Those in common use are glass, mica, porcelain, slate, India rubber, gutta percha, vulcanized fiber, paraffine, paraffine oil, and various other oils, both of animal and vegetable origin. These are all high insulators. 2. What is the most economical method of producing it for experimental purposes? A. There is no single substance of the character referred to. Each of the substances we have named above has its own process of manufacture. 3. What is the latest theory concerning the above? A. A substance which offers so high a resistance to the passage of an electric current that practically no electricity can pass through it, is called a non-conductor, and may be used for insulation.

(7695) W. P. C. asks: What length of spark must an induction coil give to successfully operate an X-ray tube? A. Coils giving a spark of an inch or even less in length have been used to produce X-ray pictures. This is due to the fact that the effect of the rays upon the plate is cumulative, and by prolonging the exposure a picture can be made with a small tube and small coil. A small coil will not operate a large tube to advantage. For successful work in penetrating the thicker portions of the body, a coil giving a spark of even fourteen inches is used.

(7696) J. T. M. asks: Will you oblige me by giving me the address of some house which can furnish all necessary material for making the electric motor which is described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 641? How can this machine be made to produce an electric light, if at all? A. The machine described in SUPPLEMENT, No. 641, was designed for a motor. If power is applied to it and it is turned at full speed, it may produce current as a dynamo, and it may not. Many little machines will not excite their own fields. You can use a battery to excite the field. It then will generate a current and will probably light a miniature lamp. For dealers in materials see our advertising columns.

(7697) G. B. O. asks: Will two equal waves of light or sound, coming from opposite directions and meeting each other, cause darkness, or stillness, respectively? A. If two waves of any sort meet each other in opposite phases, as, for instance, the crest of one falling into the trough of the other, these waves will destroy each other. This is called the interference of waves. It may be observed in water, and produced in sound, light, and electric waves. See any text book of physics.

(7698) M. R. M. asks: The way to find the magnifying power of a telescope, field and opera glass, and, so doing, your kindness will be thoroughly appreciated. A. For the magnifying power of telescopes, divide the focal length of the object glass in inches by the focal length of the eye piece in inches, if a single lens. With Huygenian, Ramsden, or terrestrial eye pieces, the method of obtaining the magnifying power is illustrated, with the forms and combination of the lenses, with the rules, in SCIENTIFIC AMERICAN SUPPLEMENT, No. 399, 10 cents mailed. The magnifying power of an opera glass is best obtained by comparison of one of the pairs of glasses by directvision of the other eye on a well defined object.

(7699) G. M. asks: Will you kindly inform me whether the armature can be wrapped with eleven coils instead of twelve in the simple electric motor described in SUPPLEMENT, 641? A. You need not rewind your armature because you have room for but eleven coils instead of twelve as designed. Make a commutator with eleven bars, the same as the number of coils, and proceed in other respects according to the directions in SUPPLEMENT, No. 641.

TO INVENTORS.

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JULY 11, 1899,

AND EACH BEARING THAT DATE.

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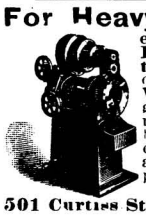

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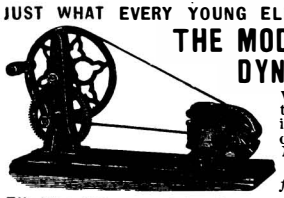

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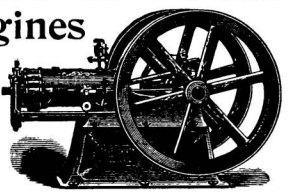

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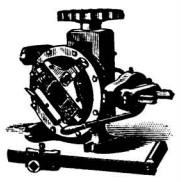

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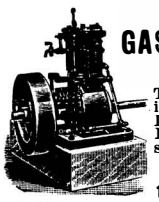

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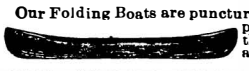

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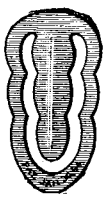

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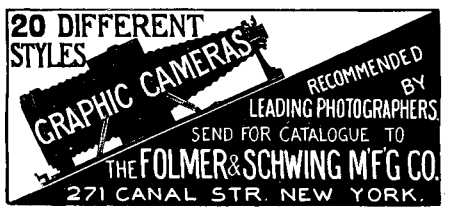
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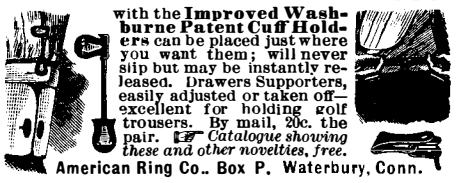

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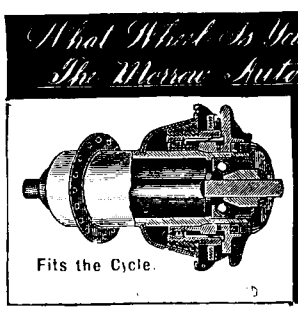
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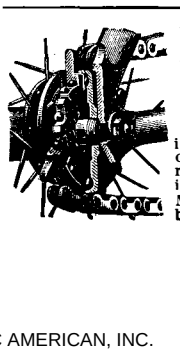

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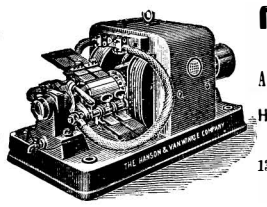

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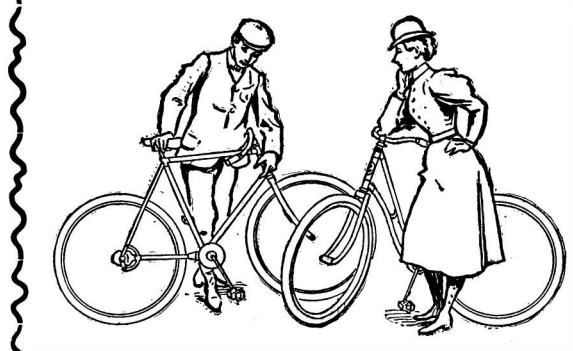

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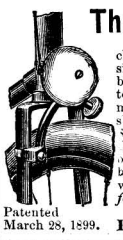

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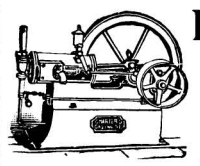

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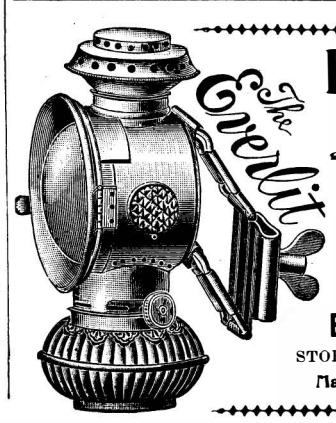

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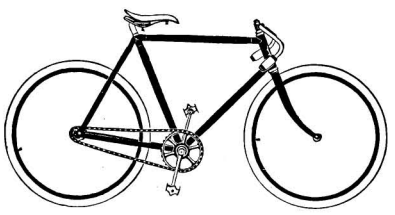

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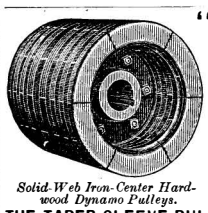

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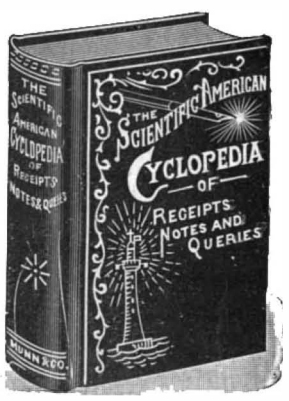

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